POSTERS

Wednesday, October 24

Posters are available 9:00 AM – 5:00 PM
All posters must be up for display on the assigned board by 9:00am
Posters are displayed for the entire poster session from 9:00am to 5:00pm
Posters taken down between 5:00 and 5:30pm
Authors of ODD numbered posters present from 9:00am to 12:00pm
Authors of EVEN numbered posters present from 2:00 to 5:00pm

Boards	Topics
Posters 1-18	Optometric Education
Posters 19-26	Cornea & Tear Measurement
Posters 27-33	Dry Eye Testing
Posters 34-44	Ocular Surface Management
Posters 45-60	Anterior Segment Case Reports
Posters 61-66	Corneal Biology
Posters 67-88	Contact Lens: Basic Science
Posters 89-104	Contact Lens: Fitting
Posters 105-110	Contact Lens: Case Reports
Posters 111-121	Contact Lens: Solutions
Posters 122-125	Contact Lens: Surveys and Vision
Posters 126-130	Contact Lens: Gas Permeable

Ezell Fellows Poster Session

Wednesday, October 24

The Academy is spotlighting a special session of poster presentations by Ezell Fellows. These posters will be displayed near the entrance of the poster hallway and will be on display for the entire meeting, from Wednesday through Saturday. Authors will be present to discuss their presentations on Friday from 2:00 to 4:00 PM.

E1. **THE INFLUENCE OF THE AMOUNT OF POWER ADDITION IN SIMULTANEOUS VISION**

Pablo de Gracia, BSc, MSc, Carlos Dorronsoro, Alvaro Sanchez- Gonzalez, Lucie Sawides, Susana Marcos, Instituto de Óptica "Daza de Valdés", Consejo Superior de Investigaciones Científicas, Serrano, Madrid, Spain

PURPOSE: To evaluate the influence of different power additions on image contrast and visual acuity. A custom-developed simultaneous vision simulator instrument is presented. **METHODS**: A simultaneous vision simulator was developed. It consists of two collinear channels that provide the eye with two simultaneous images, focused at near and far. Each channel has a motorized Badal system that allows controlling the defocus level. An artificial eye (objective lens + CCD) was used for testing the system. Images of Snellen E

targets (high and low contrast) were recorded. Channel 1 was focused at far, while the focus of channel 2 was moved from -4 to 4 D. Series of control thru-focus images were also obtained for Channel 1 only. The letter Michelson contrast was calculated for all images. Decimal VA (tumbling E letters) was also measured on 4 normal subjects (cyclopleged to emulate presbyopia) for High (HC) and low contrast (LC, 0.33) conditions. VA was measured at subjective best focus (for each channel), and then channel 2 was moved thru-focus (0 to ±4D, 0.5-1 steps) keeping channel 1 at far. Positive defocus positions emulated far vision with different adds and, correspondently, negative defocus values simulated near vision under pure bifocal corrections.
RESULTS: Changes in addition values under simultaneous conditions yielded to variations in the contrast degradation of the images. Contrast was maximally degraded (23%) for 1.5-2D add ranges, while degradation was less than 15% in the 0-1D and 2.5-4D add ranges for the HC condition. LC conditions paralleled the results of HC but with a higher maximum degradation (41%). Results were consistent across subjects both for monofocal and pure bifocal vision. Under simultaneous vision conditions VA decreased when increasing the amount of addition with a minimum (0.64) at 1.68 D, and then increased for higher addition values (0.78 for adds of 3.75 D). LC VA under simultaneous vision tended to parallel HC VA, with an average reduction of 32%.
CONCLUSIONS: Under simultaneous vision conditions low additions (1 to 2 D) result in lower visual acuities than high additions (3 to 4 D). A simultaneous vision instrument is an excellent tool to simulate bifocal vision and for increase the understanding of multifocal solutions for presbyopia.

E2. CHARACTERIZING IN VIVO CHANGES TO THE LAMINA CRIBROSA IN NON-HUMAN PRIMATES WITH EXPERIMENTAL GLAUCOMA

Kevin M. Ivers, Nripun Sredar, Nimesh B. Patel, Lakshmi Rajagopalan, Hope M. Queener, Ronald S. Harwerth, Jason Porter, University of Houston College of Optometry

PURPOSE: We present data from an ongoing longitudinal study to characterize early *in vivo* changes to the lamina cribrosa (a suggested site of initial damage to axons in glaucoma) and optic nerve head (ONH) in a monkey model of glaucoma.
METHODS: Anterior lamina cribrosa surface (ALCS) pore area, nearest neighbor distance, and elongation (ratio of major to minor axis lengths of an ellipse best-fit to each pore) were calculated from *in vivo* images acquired using an adaptive optics scanning laser ophthalmoscope (AOSLO) before and every 2 weeks after laser treatments to induce unilateral experimental glaucoma in 5 rhesus monkeys. Spectral domain optical coherence tomography (SDOCT) [Spectralis HRA+OCT] cross-sectional radial scans (20° field, 48 B-scans) and 12° circular scans (to quantify retinal nerve fiber layer [RNFL] thickness) of the ONH were also acquired using Enhanced Depth Imaging. The ALCS and Bruch's Membrane Opening (BMO) were manually marked in SDOCT B-scans to determine the anterior lamina cribrosa surface depth [ALCSD] (mean perpendicular distance between a thin plate spline surface fit to the marked ALCS points and a plane best fit to BMO). Intraocular pressure (IOP) was measured at each time (Tono-Pen XL).
RESULTS: The mean increases in IOP and ALCSD across all glaucomatous eyes (from baseline) were 17.4 ± 10.9 mmHg and 124.2 ± 73.9 μm, (t-test: $P<.05$). Increases in

ALCSD and pore geometry were measured prior to a change in RNFL thickness in 1 monkey. Three monkeys showed an increase in ALCSD before a change in RNFL thickness and pore geometry. One monkey showed simultaneous changes in ALCSD, pore geometry, and RNFL thickness.
CONCLUSIONS: Structural changes in the ALCS preceded axonal loss in most monkeys with early experimental glaucoma. Lamina cribrosa pore and ONH geometries will continue to be tracked over the time-course of IOP elevation.
ACKNOWLEDGEMENTS: This work was supported by NIH Grants R01 EY021783, R01 EY01139, and P30 EY07551; Fight for Sight Summer Student Fellowship; University of Houston College of Optometry Student Vision Research Support Grant

E3. **AN INNOVATIVE METHOD FOR DETERMINING GUINEA PIG CILIARY MUSCLE VOLUME** (120574)
Andrew D. Pucker, MS, OD, FAAO, Ohio State University College of Optometry, Ashley Carpenter, BS, Nationwide Children's Hospital, Kirk Mchugh, PhD, Nationwide Children's Hospital, Donald O. Mutti, OD, PhD, FAAO, Ohio State University College of Optometry

RESULTS: This protocol resulted in measurable reconstructions of the entire ciliary muscle in each eye preparation. There was a substantial monotonic increase in ciliary muscle volume with age. Ciliary muscle volumes for 10, 20, and 30-day old guinea pigs were 0.109, 0.197, and 0.258 mm3 respectively.
PURPOSE: Ciliary muscle development has not been documented in detail in animal myopia models. The purpose of this study was to develop a method for quantifying guinea pig ciliary muscle volume in normal animals.
METHODS: A single eye was collected from albino guinea pigs at approximately 10, 20, and 30 days post gestation. Eyes were fixed with formalin for two days and transferred to ethanol. Eyes were then processed with a Leica TP 1050 Automatic Tissue Processor (Leica Microsystems). Eyes were then imbedded in paraffin wax and 10 μm serial sections were collected. Slides were then deparaffinized and proteins were blocked via the Mouse-to-Mouse Staining System (ScyTek Laboratories). Ciliary muscle was then labeled with a primary α;-smooth muscle actin antibody (Dako) at a 1:200 dilution. The antibody was then detected with an Ultra Tek Anti-Polyvalent, HRP/AEC Kit as directed by the manufacturer (ScyTek Laboratories). Sections were then counter stained with hematoxylin. Every tenth section was visualized with an Olympus BX51 microscope, reconstructed with Stereo Investigator, and analyzed with Neurolucida Explorer software (MBF Bioscience).
CONCLUSIONS: Three-dimensional tissue reconstruction is an effective and innovative means of determining the amount of ciliary muscle present in guinea pig eyes. These data indicate that ciliary muscle volume increases with age as the eye undergoes normal development and elongation. Further study will be needed to determine if this increase represents the addition of new fibers, hypertrophy of existing fibers, or other processes. This method may also prove useful for future emmetropization studies.
ACKNOWLEDGEMENTS: American Optometric Foundation William C. Ezell Fellowship, Myopia Development in Children (U10-EY08893), Arene T. Wray Fellowship

E4. **NASAL DOMINANCE DISTRIBUTION OF LYMPHATIC VESSELS IN THE OCULAR SURFACE: POTENTIAL CLINICAL IMPLICATIONS?**

Tatiana Ecoiffier, Don Yuen, Anna Sadovnikova, Lu Chen, University of California Berkeley

PURPOSE: Recent studies from our laboratory have characterized, for the first time, the anatomical distribution of blood and lymphatic vessels in the murine ocular surface (including the cornea, limbus and conjunctiva) under both normal and inflamed conditions. Additionally, we have demonstrated that lymphatic growth occurs in the conjunctiva after inflammatory stimuli in the cornea. The purpose of this poster is to summarize these results and present the potential clinical implications of these recent findings.

METHODS: Corneal inflammatory lymphangiogenesis (i.e. the growth of new lymphatic vessels, LG) and hemeangiogenesis (i.e. the growth of new blood vessels, HG) was induced in two most commonly used mouse strains, BALB/c (6-8 weeks of age), by a standardized two-suture placement model. Oriented flat-mount corneas together with peri-limbal bulbar conjunctivae were collected for immunofluorescent microscopic studies. Blood and lymphatic vessels under both normal and inflamed conditions were analyzed and quantified by NIH Image J software to compare their distributions. The statistical significance of the difference between each group was evaluated using student *t*-test with GraphPad Prism software (GraphPad Software, Inc., La Jolla, CA).

RESULTS: Both blood and lymphatic vessels were more distributed in the nasal side in normal murine limbal ($P = 0.0036$) and conjunctival areas ($P < 0.05$). This nasal dominant pattern was maintained during corneal inflammatory LG ($P = 0.01$) while it was lost for HG. Additionally, under the inflamed condition, conjunctival lymphatic vessels showed a higher density and more branching points, indicating that LG occurs in the conjunctiva in response to corneal inflammation ($P < 0.05$).

CONCLUSIONS*:* Blood and lymphatic vessels are not evenly distributed in the ocular surface. In response to an inflammatory stimulation imposed on the cornea, LG occurs both at the site and in the neighboring tissue of the conjunctiva. These new findings will shed some new light on our understanding of the anatomy, physiology, and pathogenesis of the ocular surface, and the development of experimental models and therapeutic strategies for relevant diseases as well.

ACKNOWLEDGEMENTS: This work is supported in part by research grants from National Institutes of Health, Department of Defense, and the University of California at Berkeley (to L.Chen.). Tatiana Ecoiffier is an Ezell Fellow from the American Optometric Foundation.

E5. **OCULOMOTOR-BASED VISION REHABILITATION (OBVR) FOR READING EYE MOVEMENTS (REM) IN MILD TRAUMATIC BRAIN INJURY (MTBI) (125336)**

Preethi Thiagarajan, BSOptom, MS, FAAO, Kenneth J. Ciuffreda, OD, PhD, FAAO, Diana Ludlam, COVT, Neera Kapoor, OD, MS, FAAO, State University of New York College of Optometry, Jose E. Capo-Aponte, OD, PhD, FAAO, Visual Sciences Branch, US Army Aeromedical Research Laboratory

RESULTS: Following OBVR, the SFR reduced (2.2 to 1.8) significantly ($p < 0.01$). In addition, the overall CISS score reduced significantly ($p<0.01$), and the duration of comfortable reading increased significantly ($p = 0.04$) with the reading rating-scale questionnaire. With the Visagraph, mean reading rate increased by 12 words/min (from 153 to 165), and the number of progressive and regressive saccades executed reduced by 9% and 14%, respectively; however, these differences were not statistically significant.
PURPOSE: To evaluate objectively the effect of OBVR on REM in mTBI.
METHODS: Binocular horizontal eye movements were recorded objectively in 10 visually-symptomatic individuals with mTBI (mean age 29 years) using the Arrington ViewPoint Binocular EyeTracker (220Hz sampling rate; resolution 0.1 deg) to a "multiple-line, simulated reading" test paradigm. A single dot target randomly moved step-wise (1, 2, or 3 degree steps, 10 steps/line, 10 lines in total) on a computer screen at 40 cm. Subjects were instructed to saccade as accurately and rapidly as possible to the target changes. The parameter of "saccade frequency ratio" (SFR = number of saccades executed/number of step target changes) was calculated; a value of 1.0 would reflect perfect saccadic tracking. REM was recorded using the commercially-available Visagraph device to 10th grade level paragraphs. Reading-related symptoms were assessed using the convergence insufficiency symptom survey (CISS) and a reading rating-scale questionnaire specific for TBI (Han et al., 2004). All measures were compared statistically before and after OBVR (6 weeks, 2 sessions/week, 20 minutes/session, total of 240 minutes). This training was part of a comprehensive OBVR also including accommodation and vergence components.
CONCLUSIONS: Reduced saccade frequency ratio demonstrated improved rhythmicity, accuracy, and sequencing of saccades following OBVR in mTBI as a result of oculomotor learning. This was reflected in the ameliorated symptoms with improved reading ability.

E6. REVEALING A MICROSCOPIC SENSITIVITY GRADIENT IN THE HUMAN RETINA WITH ADAPTIVE OPTICS

W.S. Tuten, W.M. Harmening, Austin Roorda, University of California Berkeley, L.C. Sincich, University of Alabama at Birmingham

PURPOSE: To compare parafoveal visual thresholds measured on single cone photoreceptors with those measured in the spaces between cones, using adaptive optics scanning laser ophthalmoscopy (AOSLO).
METHODS: A multi-wavelength AOSLO was used to conduct high-resolution retinal imaging and visual sensitivity testing in three subjects with normal color vision. High-speed eye tracking enabled the delivery of aberration-corrected stimuli ($\lambda = 543$ nm) to targeted retinal loci. Image-based methods were employed to measure and correct for transverse chromatic aberration (TCA). Increment thresholds were measured against a 2.8 log Troland background at retinal eccentricities ranging from 3° to 5°. Test stimuli were targeted either (1) directly on a cone or (2) to the inter-cone space directly adjacent. Thresholds were acquired 3 to 5 times at each location. A model incorporating stimulus delivery data and eccentricity-dependent cone aperture size was used to estimate light capture in the cone mosaic for each measure of threshold.

RESULTS: A total of 20 cones were tested. The ratio of thresholds for the off-cone and on-cone conditions was above 1.0 for each site tested, with 12 reaching significance via two-tailed t-test ($p<0.05$). The mean threshold ratio across all subjects was 1.48. Visual thresholds decreased as the amount of light integrated into the cone mosaic increased ($R^2 = 0.33$).
CONCLUSIONS: As expected, the peaks and valleys of the parafoveal visual sensitivity gradient are correlated with cone centers and inter-cone gaps, respectively. These effects are manifest as close as 3° eccentricity, where inter-cone spacing is on the order of 1.5 arcmin. Our findings suggest that, with quality eye tracking, high-order aberration correction and TCA compensation, AOSLO can constrain light delivery to an area on the order of a parafoveal cone.
ACKNOWLEDGEMENTS: WST: NIH T32 EY007043, AOF Ezell Fellowship; WMH&AR: NIH EY021642; WMH: DFG Fellowship Ha 5323/2-1; AR: NIH EY014375; LCS: NIH EY019566, Eyesight Foundation of Alabama.

E7. A HIGH PERFORMANCE VIDEO INTERFEROMETER FOR EVALUATION OF THE TEAR FILM LIPID LAYER

Daniel Powell, OD, MS, Ewen King-Smith, PhD, FAAO and Heather L. Chandler, PhD, FAAO, The Ohio State University College of Optometry

PURPOSE: Poor spreading and/or deficiency of the tear film lipid layer (TFLL) are believed to be major contributors of evaporative dry eye disease. A novel method of TFLL imaging provides additional information about the thickness and spreading characteristics of this layer compared to current imaging systems.
METHODS: The high performance video interferometer (HPVI) images a 6 mm-diameter area of the pre-corneal tear film over a 40 s period. Features incorporated into the HPVI: 1) A high performance video camera capable of recording 68 images/s; 2) A stroboscopic light source (< 40 μs duration) that minimizes image blurring from eye and TFLL movements; 3) Enhanced resolution of 1400 X 1100 pixels; 4) Immediate examiner feedback to aid proper eye alignment; 5) Image processing software that records time and duration of a blink to allow for TFLL evaluation immediately pre- and post-blink.
RESULTS: Video recordings of the right eye were taken on 16 healthy non-contact lens wearers (mean age 26.8 ± 5.2 years; 69% female). During the downward stroke of a blink, TFLL wrinkling was observed up to several mm below the upper lid, while lipid accumulated in a thick band closer to the lid. Early in the upstroke, this thick lipid was deposited in the TFLL, with decreasing lipid deposited later on, causing a lipid thickness gradient. Upward drift of the TFLL after the blink generally reduced or eliminated this gradient at later times.
CONCLUSIONS: The HPVI, a viable tool in imaging the TFLL, offers several advantages over other systems (Doane, 1989; DR-1 interferometer). In addition to providing information on the thickness and spreading properties before, during, and after a blink, the HPVI also provides valuable insight on how the mechanical properties of a blink may affect the TFLL.
ACKNOWLEDGEMENTS: NIH/NEI funding: DRP (EY015539) and EKS (EY017951); Ezell Fellowship: DRP

1. **PREDICTORS OF ACADEMIC SUCCESS FOR MCO STUDENTS** (125051)

Robert S. Buckingham, OD, PhD, FAAO, Sara Bush, OD, Michigan College of Optometry

RESULTS: Using linear regression analysis on the interval data, the study finds that the Optometry Admission Test (OAT) Academic Average and, based upon the year of the student, the OAT Reading Comprehension and pre-optometry GPA in math, biology, and non-science, are predictors for first, second, third, and fourth year optometry GPAs. In addition, the study reveals that both OAT scores and undergraduate course GPAs are better predictors of first, second, third, and fourth year optometry GPAs than undergraduate course GPAs alone. Thus, the standardized OAT does add value to the selection process. In reference to predicting the nominal variable, graduation, logistic regression revealed different findings. Using a 50% cut off for evaluating graduation, the logistic regression equation sensitivity for the study was 96.3% and the specificity was 0%. Therefore, the logistic regression equation did not reveal any variable which were predictive of identifying individuals who will not graduate from the MCO.
PURPOSE: Optometry school admissions are very competitive. With more applicants than available slots, admission committees must choose those students whom they feel will be successful graduates. With the advent of Optometry Centralized Applications Service (OptomCAS), this study evaluates the ability of these variables to predict the GPA and graduation of students in the Michigan College of Optometry (MCO).
METHODS: The study employs a non-experimental, ex post facto research design which covers students who entered the MCO from 1995 through 2004. The sample size includes 322 subjects who took 13,203 courses. All courses taken by students are categorized into the OptomCAS variables. Using linear regression and logistic regression, these variables are evaluated for the predictability of academic success.
CONCLUSIONS: Overall, the results of the study increase the current knowledge on optometry school selection criteria variables and the importance of the OptomCAS variables. It also provides optometry admission committees additional information to improve their selection process.

2. **EVALUATION OF A NEW CLINICAL EDUCATION TRAINING PROGRAM FOR 3RD YEAR OPTOMETRY STUDENTS** (125064)

Leon Nehmad, OD, MSW, FAAO, Julia Appel, OD, FAAO, State University of New York (SUNY) College of Optometry

BACKGROUND: We present the results of an initial, detailed student satisfaction survey developed in an effort to evaluate the effectiveness of a new 3rd year clinical training program at SUNY College of Optometry. The program consists of 6 student/2 doctor teaching pods in Primary Care (PC) clinic as well an expansion of Specialty clinic exposure in 3rd year to include Vision Therapy (VT), Contact Lens (CL), Ocular Disease (OD), Pediatrics (P), and Dispensing (D). The survey consisted of the same questions for each clinic and related to supervisor availability, use of evidence-based medicine,

emphasis on critical thinking, adequacy of number of patient encounters, and overall evaluation of the learning environment. Responses could be rated as Poor, Fair, Good, Very Good or Excellent. All sections were also open for student comments.
CASE REPORT(S): The percent of answers that were rated as Good or better for each clinic on the questions of supervisor availability, critical thinking, evidence-based medicine, patient encounters, and overall learning, respectively, was for PC (n=71) 98, 90, 90, 50, 87; VT (n=53) 98, 94, 96, 68, 94; P (n=29) 97, 100, 80, 48, 79; OD (n=25) 84, 96, 80, 71, 68; CL (n=28) 96, 93, 89, 29, 93; and D (n=50) 91, 82, 86, 92, 85.
CONCLUSIONS: Satisfaction with the program was high among 3rd year students for most areas in PC and Specialty clinics, with differences among clinics being relatively small. The primary area of dissatisfaction in all clinics save for Dispensing was in the low number of patients seen. Other areas of dissatisfaction reflected in the comments concerned grading, balance of patient scheduling, staffing and clinic administration issues. Survey results are being utilized to refine the clinical training program at the College.

3. **STRATEGY AND RATIONALE FOR THE DEVELOPMENT OF AN INTERACTIVE SPECTACLE LENS SELECTION APPLICATION** (125119)
Kenneth R. Seger, OD, MSc, FAAO, Arne Patrick, OD, Alan Kabat, OD, FAAO, Greg Fecho, OD, Justin Coleman, BS, Nova Southeastern University College of Optometry

BACKGROUND: Optometry students are being barraged by an ever increasing amount of information. New lens materials, designs, and coatings are being introduced at a breathtaking pace. To ease the student's burden, NSUCO faculty and students have joined together to create an electronic application to aid recommending spectacle lens products. It is anticipated this "app" will suitably fit their lifestyle.
CASE REPORT(S): To begin this project a spectacle needs questionnaire was designed and tested on approximately 50 patients in the school's Primary Care Service. In an attempt to allow the student to learn the senior clinician's rationale, after dilation a faculty member skilled in ophthalmic dispensing discussed the answers with the patient, and then made recommendations. Based on this experience the question was refined and incorporated into the initial electronic application. This is an algorithm that quantifies responses from questionnaires given to both the patient and the student. The responses from each are compared to a database of lens material, design, and coating attributes. The app will provide recommendations based on the likelihood that higher scoring products will meet most of a patient's needs. This phase will be tested later in the year. To enhance the educational process, a quiz function will be added to the app that requires students to anticipate the patient's lens requirements prior to seeing the results. The written questionnaire and the algorithm for the initial electronic application (incorporating the algorithm) will be displayed.
CONCLUSIONS: The creation of an electronic application for recommending spectacle lens products is not a substitute for traditional analysis of a patient's needs by the student. Rather, it is meant to draw together the numerous options available so that patients can get precisely what they need and students can learn from the recommendations. Its format should be appealing to digitally savvy Generation Y students.
ADDITIONAL COMMENTS: Thanks to the NSU College of Optometry

4. **ACADEMIC INTEGRITY IN OPTOMETRY STUDENTS** (125139)

James R. Miller, OD, FAAO, Michigan College of Optometry, Jill Leisner, OD, Big Rapids, MI, Brandon Larson, OD, Twin Cities, MN

BACKGROUND: Purpose - As a response to the recent high profile problems with regard to academic dishonesty and optometry students, this study intended to investigate the optometry students' definition of academic dishonesty and to discover the reasons why students may compromise their integrity.
CASE REPORT(S): Methods - An online survey with multiple response options was emailed to approximately 150 current and past optometry students from the Michigan College of Optometry. The students were asked to give their evaluation of various degrees of academic dishonesty and potential reasons. Results - 104 students responded to the survey. Numerous surveyed behaviors showed strong consensus from the students as either being honest or dishonest and these responses were generally in line with most faculty expectations. However, some behaviors had less student consensus and some conflicted with faculty perceived and/or communicated expectations. While more than half (57%) of the students polled stated they would rather fail than behave dishonestly, "to avoid/fear of failing" (32%) or "to ensure passing the course" (19%) were the top two options students selected to rationalize dishonest conduct.
CONCLUSIONS: Conclusions - There is certainly some diverse opinions from students as to which behaviors constitute academic dishonesty. With this information, it might be helpful for faculty to more clearly define and explain their expectations for academic integrity especially since faculty many times have diverse expectations themselves.

5. **A MODEL OF INTER-INSTITUTIONAL COLLABORATION USING TECHNOLOGY FOR SCHOOLS AND COLLEGES OF OPTOMETRY** (125147)

Ida Chung, OD, MSHE, FCOVD, FAAO, State University of New York (SUNY) College of Optometry

BACKGROUND: Optometry is facing a faculty shortage. Utilization of technology to support inter-institutional collaboration can provide a timely solution. Collaboration through technologies enhances individual institutions' curriculum offerings, promotes faculty development, creates an interactive and more diverse learning environment for students, and promotes cost savings. This study determined the administrator's attitudes toward technology utilization and collaboration.
CASE REPORT(S): A 12 question survey instrument with a primarily quantitative emphasis was designed to collect data. The survey was sent electronically to the 20 Chief Academic Officers at each of the US schools and colleges of optometry. There was a 100% response rate. Interests in specific inter-institutional collaboration projects range from enhancing existing programs in the area of graduate education, faculty development, and international education, to establishment of new programs such as sharing elective courses, collaborative faculty teaching, and sharing course content. The results indicted hesitancy by administrators towards sharing faculty and course content. Perceived barriers to inter-institutional collaboration include cost of initial technology investment, intellectual property concerns, and limited faculty resources.

CONCLUSIONS: The findings showed the majority of administrators share a vision and desire to use technology to enhance teaching and develop faculty. To move forward with successful collaborative efforts, perceived barriers must be recognized and addressed. Additionally, a survey of the faculty for their interests and potential projects for inter-institutional collaboration should be carried out. The Association of Schools and Colleges of Optometry (ASCO) sees utilization of technologies for faculty development as a strategic priority. ASCO can assist in the communication and integration of recommended project collaborations.
ADDITIONAL COMMENTS: Acknowledgement goes out to ASCO for their administrative support in carrying out the survey.

6. **HOW DIFFERENT CAN GLOBAL VS. STRUCTURED MARKING BE IN OPTOMETRY?** (125233)

Barbara M. Junghans, BOptom, PhD, FAAO, University of New South Wales School of Optometry and Vision Science

BACKGROUND: Optometry UNSW has long endorsed competency-based performance review of pre-clinical skills. Until 1999 competency on intricate tasks taking 15+ mins to execute was simply assessed subjectively by an examiner giving a global mark. Many students felt aggrieved. To redress this, a system of criticality ratings for each stage of various skill protocols was adapted from UAB and the effect upon student grades analysed.
CASE REPORT(S): Fulltime clinical staff assigned every step of a protocol a 1-10 rating based on the impact that action has on the outcome and delivery of appropriate care. An objective mean criticality rating was thus created for each step of refraction, biomicroscopy, tonometry, etc. At the peer-on-peer exam the examiner need only tick whether that step was completed successfully yes.no. Criticality ratings were then assigned to all yes scores post-exam. However, to better understand the impact of other nuances, examiners were asked to also give a traditional global mark, and assign Likert-scale ratings for time efficiency and professionalism. An analysis was undertaken against the subjective global marks for those staff with significant involvement over the last 4 years (n=224 students). Objective ratings were higher on average ($p<0.001$) by 12.8±8.3 to 15.2±9.9% (95%CI) than corresponding subjective marks (depending on skill station). Differences for individuals ranged from a subjective mark 11.4% above to 58.7% below the objective mark. The 9 examiners differed significantly ($p<0.001$) and some always marked harder than the objective mark suggested. Subjective global marks ratings correlated significantly with time efficiency and professionalism ratings ($p<0.001$) for every examiner at every station. Despite a bias to mark harder, subjective marks correlated highly with objective marks ($p<0.001$).
CONCLUSIONS: Although students can be deemed technically competent through structured skill analysis, other elements appear to play a significant role in executing clinical tests. To what degree should quality control be imposed? Combining grading systems appears fairer.

7. **ADVANCED STUDIES IN CONTACT LENS AT PCO AT SALUS UNIVERSITY** (125253)

Melissa A. Vitek, BS, OD, Melissa Trego, OD, PhD, Linda Casser, OD, FAAO, Pennsylvania College of Optometry at Salus University

BACKGROUND: Launched in 2010, PCO is the only optometric institution to offer Advanced Studies certificates to students enrolled in their Doctor of Optometry degree program who wish to be trained beyond the entry-to-practice level in specific content areas. Content areas include Advanced Studies in Anterior Segment, Advanced Studies in Retina, Advanced Studies in Clinical Medicine and, new this year, Advanced Studies in Contact Lens.
METHODS: To be considered for Advanced Studies, students enrolled in the Doctor of Optometry degree program must be in their third year of study; must be in good academic standing within the core curriculum at the time of application, and they must achieve a minimum grade of "B" in the basic core curriculum courses related to the Advanced Studies program. The Advanced Studies curriculum emphasizes small group learning, therefore there is a limit of 20 students accepted into each content area. Advanced Studies in Contact Lens, launched February of 2012, boasts the distinction of reaching this limit the first year.
RESULTS: Parts 1 and 2 of Advanced Studies in Contact Lens, emphasizing applications for regular and irregular corneas respectively, include lecture, case analysis, and workshops and are offered in their third year. Part 3 is an on-line course focusing on contact lens complications and is taken during the fourth year. Part 4 is a clinical externship at an approved Advanced Studies site. In addition, enrolled students, with the mentorship of a Lead Instructor, are required to write case reports and conduct literature reviews. Since Advanced Studies courses are optional, there is additional associated tuition. Students who successfully complete all four parts receive a certificate of completion.
CONCLUSION: It is clear that interest exists in the expansion of knowledge on the applications of contact lens. PCO is also poised to launch an International Certificate of Concentrated Study in Contact Lens in the Fall of 2012. Likewise, plans are in place to develop a CE certificate in contact lens offering.

8. CREATION OF A SCHEME TO RAISE AWARENESS OF OPTOMETRY & OPTICS AS CAREER OPTIONS FOR 14-16 YEAR OLDS (125283)

Karen N. Sparrow, BSc, MCOptom, FAAO, Vision Aid Overseas, David Thomson, Professor, City University, Ellen Colquhoun, BA (Hons), ACIM, ACIPR, The College of Optometrists, Leah Newby, BA, Wharfebank House

BACKGROUND: An increase in the number of training places combined with a reduction in applicants have made it more difficult to recruit good quality students to optometry degree programmes in the UK. This scheme aims to raise awareness of optics as a career choice in schools, improve the calibre of applications to universities and target specific regions where recruitment challenges exist.
CASE REPORT(S): Initial research by a 17-member cross sector working group suggested that conventional methods are no longer effective strategies for attracting high quality students into optometry and optics. Instead innovative workshops were developed to be delivered by optometrists and opticians ('ambassadors'). The workshops consist of

three interactive zones: the Illusion Zone; the Testing Zone and the Future Zone. The session concludes with a brief 3D film commissioned specially for the workshop. The workshops are linked to the national curriculum for 14-16 year olds, supported by resources for the students, teachers and ambassadors and linked to an interactive website www.newdimensioninoptics.org . The workshop was piloted with 300 students in 7 schools. Following the workshop 77% said they were more aware of the importance of eye health, 55% 'agreed' or 'strongly agreed' that they would recommend Optometry and Optics as a good career choice and 79% were able to recall the difference between an optometrist and a dispensing optician 7 weeks after the event. Teachers also endorsed the workshop, with 100% reporting that it raised the profile of optometry and optics as a career choice.
CONCLUSIONS: This approach to student recruitment has been shown to be extremely effective and has won a number of awards. It is hoped that workshops will be delivered in 2000 schools during the next academic year. The long-term success of the initiative will be carefully monitored by identifying applicants who have been influenced by the campaign and subsequently enter a career in optometry or optics.

9. **NET PROMOTER SCORE FOR VISION CORRECTION** (125374)

Bill Long, BS, FAAO, FBCLA, Sander Dorfzaun, OD, Marietta, GA, Jason R. Miller, OD, MBA, FAAO, Powell, OH, Glenda B. Secor, OD, FAAO, Huntington Beach, CA

RESULTS: 159 surveys were returned from 93 (58%) females, 61 (38%) males, and 5 (3%) no sex answered. No statistically significant difference (SSD) was found for years of experience with their primary vision correction modality and sex (p=0.5552, t-test). A SSD was found for primary vision correction modality and years of experience with the primary vision correction modality (p=0000, ANOVA). Net promoter scores were for spectacles 29%, n=35, soft contacts 76% n=38, hard contacts 54% n=24, reading glasses 33% n=24, surgery and using a correction device 35% n=21, and surgery with no correction device 64% n=16, and 1 no answer. There was no statistically significant difference for the distribution of scores among primary vision correction modalities (p=0.2851, Chi square).
PURPOSE: To profile the net promoter score for vision correction devices and vision correction surgery among patients attending normally scheduled visits at eye care practices that prescribe vision correction devices and provide eye care to patients who have had vision correction surgery.
METHODS: Three sites gave surveys to sequential, qualifying patients who presented for normal appointments over a 10 week period. A qualifying patient was one whose primary vision correction modality was spectacles, soft contacts, hard contacts, reading glasses, surgery and using a correction device, and surgery with no correction device. Subjects were provided envelopes for returning their survey and masking investigators to their response. No sample size estimate for statistical significance was made for this pilot study.
CONCLUSIONS: An article in the December 2003 issue of Harvard Business Review proposed that a score calculated from a single question (How likely is it that you would recommend company X to a friend or colleague?) might be the most effective indicator of business growth. Applying this concept to vision correction modalities, this pilot study

found that soft contact lens wearers are the most and spectacles wearers are the least likely to recommend their modality to a friend or colleague.

10. **EXTERNSHIP MATCHING ALGORITHM IMPROVES EFFICIENCY AND PROCESS CLARITY** (125410)

Elli J. Kollbaum, OD, FAAO, Martin Rickert, PhD, Pete S. Kollbaum, OD, PhD, FAAO, Indiana University

BACKGROUND: Across degree programs for health professions, practical experiences are a significant part of the curriculum. Residencies in optometry and other doctoral level health professions utilize blind matching processes which remove elements of human bias and influence. Externship matching in optometry is completed in a variety of methods. Previously, at Indiana University, it had been a paper-based process with students listing site preferences and a combination of faculty and staff completing the matching process based on discussion of each individual preference. The process lacked efficiency and the paperwork did not contain a linear ordering of the preferences. The current project details a computer-based algorithm, which was designed to streamline the process.
CASE REPORT(S): A secure online survey was developed (Qualtrics, Inc., Utah, USA) which allowed students to specify up to 18 different site preferences and the corresponding quarter (i.e. spring, summer, winter, fall) of these preferences. A computerized algorithm was developed in R version 2.11.1 (R Development Core Team, 2010) which performed multiple iterations to assign rotation sites based on curriculum requirements, class rank, student preferences, and availability of quarter and site. The algorithm also includes a mechanism for comparing each student's assigned rotation sequence with their ideal sequence of externships. Previously, the matching process took approximately three days for one faculty member and one staff member. With the new system, 75 students were successfully assigned in less than 60 seconds.
CONCLUSIONS: The automated, computerized externship matching algorithm improved efficiency, fairness, and clarity in the externship matching process.

11. **DEVELOPMENT OF SLIT LAMP BLUE-LIGHT FILTERS TO REDUCE RISK OF PHOTOCHEMICAL RETINAL DAMAGE IN OPTOMETRY STUDENTS LEARNING SLIT LAMP OPHTHALMOSCOPY** (125428)

Helene M. Kaiser, OD, FAAO, Pennsylvania College of Optometry at Salus University

RESULTS: The slit lamp blue-light filters decreased the overall light intensity by 19.1%. The filter also removed all wavelengths from the spectrum under 480 nm, including light in the blue/violet range as well as all UV light produced by the halogen light bulb. Previous studies have shown that the blue-light filter increases the MPE by a factor of 20. The increase of the MPE times would allow dilated optometry students to practice ophthalmoscopy skills on each other for longer periods of time without risking retinal damage from blue light energy.
PURPOSE: Slit lamp ophthalmoscopy can present a blue-light hazard with the capability of causing photochemical damage to the retina. The established maximum permissible exposure times (MPE) of clear high plus lenses used in ophthalmoscopy range from 32

seconds (Super 66) to 57 seconds (Superfield NC). In an effort to increase the MPE for ophthalmoscopy, a slip-on blue-light filter was created and evaluated for its ability to reduce the short wavelength energy produced by slit lamp halogen bulbs.
METHODS: A slip-on blue-light filter was created for the Topcon and Zeiss style slit lamps which could be used universally for all high plus powered ophthalmoscopy lenses. Spectral radiometric measurements were taken with a standard halogen bulb equipped slit lamp both with and without the slip-on blue-light filter and the results were comparatively studied.
CONCLUSIONS: In the optometry school pre-clinic teaching laboratory, a slip-on blue-light filter could be used when the students are subjected to prolonged or repeated examination by ophthalmoscopy. The blue-light hazard, which is both additive and cumulative, would be markedly reduced and protect students from potential retinal damage for substantially longer periods of exposure time. The slit lamp slip-on filters would extend the safe MPE time of the 78 D ophthalmoscopy lens using high intensity light from an average of 36 seconds to 12 minutes before significant retinal photochemical damage would likely occur.

12. **DEVELOPMENT OF AN ADAPTABLE ONLINE OPTOMETRIC QUIZ SITE** (125460)

Pete S. Kollbaum, OD, PhD, FAAO, Indiana University School of Optometry School of Optometry, John M. Jackson, OD, MS, FAAO, Southern College of Optometry, Brandon Koh, MS, Indiana University School of Optometry

BACKGROUND: Educators often use sample problems, quizzes, and tests. This typically requires the instructor to create several questions all covering the same idea, but with different inputs leading to different answers. There is considerable effort required of the instructor to create these problems, and also go over these problems with students, and grade them. The current project highlights the development of an adaptable online quiz site capable of benefiting both optometric students and educators.
CASE REPORT(S): We adapted WeBWorK (Mathematical Association of America), an open-source online homework system for math and science courses, to allow use by optometry students and eyecare providers. Although WeBWorK is supported with a National Problem Library (NPL) of over 20,000 problems, it contained no appropriate optics or optometry related problems. We created and implemented a problem set of contact lens and optics questions for use by optometry students and faculty.
CONCLUSIONS: A free, optometry related online problem set, homework and quiz site is available for use by optometric educators and students, as well as eyecare providers around the world.
ADDITIONAL COMMENTS: Project support provided by Bausch and Lomb and the Association of Contact Lens Educators.

13. **PERCEPTIONS OF OPTOMETRY STUDENTS AND RESIDENTS REGARDING THE BENEFITS OF RESIDENCY TRAINING** (125469)

Shannon Bligdon, Stacey Keppol, Nicole B. Quinn, OD, FAAO, Stacy A. Lyons, OD, FAAO, New England College of Optometry

RESULTS: The survey response rate for fourth year students and current residents was 42.59% and 48.48%, respectively. Both fourth year students and current residents believe the top three reasons for completing a residency are to improve clinical skills, improve confidence as a clinician and to specialize in an optometric specialty. Both groups identified accomplishments that were viewed to be important to their professional development (e.g. serving as a preceptor to optometry students, becoming a fellow in professional organization). ~80% of respondents felt that they would be more likely to accomplish these goals having completed a residency. Both fourth year students and current residents believe that completing a residency program will expand potential employment opportunities. The preferred mode of practice for over 50% of both fourth year students and current residents is group private practice. Solo private practice and commercial practice were least likely to be chosen as the preferred mode of practice for both groups.
PURPOSE: The purpose of this project was to identify the perceptions of fourth year optometry students and current residents at the New England College of Optometry (NECO) regarding reasons to pursue an optometric residency and the potential impact of completing an optometric residency on their future career path.
METHODS: Fourth year optometry students at the New England College of Optometry (NECO) and residents in NECO-affiliated residency programs were invited by email to participate in an anonymous Zoomerang survey during February 2012. The survey was comprised of approximately 10 questions pertaining to reasons for completing a residency and the perceived impact of completing a residency program on their future career.
CONCLUSIONS: Fourth year students and current residents at NECO have similar motivating factors for pursuing residency training and believe that completing an optometric residency can improve the likelihood of accomplishing certain goals considered important to their professional development.

14. **STUDENT PERCEPTIONS OF TEAM BASED LEARNING IN GEOMETRICAL, VISUAL, AND PHYSICAL OPTICS** (125479)
John M. Jackson, OD, MS, FAAO, Southern College of Optometry

BACKGROUND: Team Based Learning (TBL) uses classroom time for application of material students learn on their own before class, instead of traditional lectures. This "flipped classroom" model was used by the author for the second time in Fall 2011 for the optics course. This study assessed student perceptions of this novel classroom model.
CASE REPORT(S): METHODS: To assess the student's perception of the experience, they took the "Team-Based Learning Student Assessment Instrument" (TBL-SAI) developed by Heidi Mennenga, PhD. This is a 33-question instrument divided into three subscales: Accountability, Preference for Lecture or Team-Based Learning, and Student Satisfaction. The questions use a 5-point Likert scale (1=strongly disagree, 5=strongly agree). **RESULTS:** 120 out of 130 students (92%) responded to the survey. The overall results were positive with regards to their perceptions of TBL. The mean responses for

each subscale are as follows: Accountability 4.18 +/- 0.27; Preference 3.69 +/-0.43; Satisfaction 4.03 +/-0.31. Each subscale shows a favorable response to TBL, with Preference showing the least positive effect. Within each subscale there were between 1-3 items that scored significantly differently than the mean.
CONCLUSIONS: The overall perception of TBL was positive for this group of students. The results were especially favorable in the Accountability subscale, with students indicating TBL provided motivation to prepare for class and perform well on team assignments. The responses were somewhat more neutral-to-positive on the Preference subscale, and this section had the largest number of items that differed from the mean. TBL appears to have left an overall positive impression on the students and motivated them to prepare and perform well.

15. **EVIDENCE-BASED PRACTICE TEACHING IN OPTOMETRY: A NEW SURVEY METHOD FOR IDENTIFYING QUALITY TASKS IN EXISTING CURRICULA** (125510)

Isabelle Jalbert, OD, PhD, FAAO, Catherine Suttle, PhD, MCOptom, Kirsten Challinor, PhD Psych, University of New South Wales School of Optometry and Vision Science

BACKGROUND: Responsibilities for eye care make Evidence-based practice (EBP) essential in the profession of optometry. An important part of optometric training is the acquisition of skills and knowledge needed for EBP. The current study examined an undergraduate optometry curriculum to determine where components of EBP are currently taught and to identify the best existing EBP teaching strategies.
CASE REPORT(S): Optometry course conveners (17) at the University of NSW, Australia, were interviewed to obtain information about current EBP teaching strategies. Data for 33 Optometry courses were categorised according to the five EBP steps specified in the Sicily statement: Ask, Acquire, Appraise, Apply and Audit (Dawes et al., 2005). Strategies were subjectively rated for EBP quality on a 4 point scale. The survey identified 58 strategies currently in use to develop EBP skills and knowledge. More than half of the strategies identified were assessment tasks (32), and 57% of strategies focused on more than one EBP step. Strategies were most frequency assigned to principles 'Appraisal' and 'Acquire' (34 and 31 counts respectively), whereas fewer strategies reflected skills relating to Asking (25), Applying (8) and Auditing (9) evidence-based practice. Across the Degree, 28% of strategies were given the highest EBP rating subsequently followed by 19%, 36% and 17% for the next 3 categories respectively. Early stages of the program had more tasks teaching Acquire and Appraise principles, compared to later stages which instead had a higher number of Apply and Audit related strategies.
CONCLUSIONS: The EBP teaching strategies identified are informing the development of teaching and learning materials to be embedded into Optometry curricula. A central online resource is being designed to support these strategies. It will consist of optometry-specific scenario-based materials, including clinically-relevant materials (e.g. hypothetical cases) and self-assessment materials to support learning and teaching of EBP knowledge and skills
ADDITIONAL COMMENTS: ALTC funded project.

16. **IMPACT OF OPTOMETRIC RESIDENCY TRAINING ON FUTURE CAREER PATH** (125541)

Stacey Keppol, Shannon Bligdon, Nicole B. Quinn, OD, FAAO, Stacy A. Lyons, OD, FAAO, New England College of Optometry

RESULTS: 270 NECO alumni responded to the survey, with 114 (42.2%) having completed an optometric residency and 156 (57.8%) having not. 50% of residency trained respondents report current employment in a setting that recommends or requires residency training. The majority of all survey respondents work in a group private practice. Non-residency trained respondents are more likely to work in solo private practice or commercial settings. Residency trained respondents are more likely to work in health centers, hospitals and educational settings. 99% of residency trained respondents indicated participating in one or more professional activities (e.g. presenting posters or manuscripts, clinical research, leadership positions in professional organizations, clinical precepting of optometry students) compared to 57.7% of non-residency trained respondents.

PURPOSE: Many residency programs believe that their graduates will acquire skills during residency training that will facilitate further contributions to the optometric profession. These contributions include participating in professional organizations, becoming involved in scholarly activities, and conducting clinical research. The purpose of this project was to compare the career paths of graduates from the New England College of Optometry (NECO) who completed a residency to those that did not.

METHODS: A survey was developed and distributed to alumni from the New England College of Optometry (NECO) who graduated between 1995 and 2011 via Constant Contact. The anonymous survey was conducted via Zoomerang during February and March 2012. Respondents were asked whether or not they completed an optometric residency, as well as questions pertaining to their mode of practice and participation in professional activities.

CONCLUSIONS: There are differences in career paths, mode of practice, and type and level of involvement in professional activities between graduates from NECO who completed a residency program compared to those who did not.

17. **INTERPROFESSIONAL EDUCATION – CHALLENGES WITH IMPLEMENTATION IN AN OPTOMETRIC CURRICULUM** (125337)

Srihari Narayanan, OD, PhD, FAAO, Patricia Sanchez-Diaz, PhD, Timothy A. Wingert, OD, FAAO, University of the Incarnate Word Rosenberg School of Optometry

BACKGROUND: The World Health Organization describes Interprofessional Education (IPE) as "When students from two or more professions learn about, from and with each other to enable effective collaboration and improve health outcomes." The University of the Incarnate Word has set forth a process to implement IPE among the five health professions schools at the university (Optometry, Nursing, Pharmacy, Physical Therapy and Health Administration).

CASE REPORT(S): IPE has four core competency domains. Values and Ethics (VE), Roles and Responsibilities (RR), Interprofessional Communication (CC) and Teams and

Teamwork (TT). We have noted that the Optometry curriculum (at our institution) only satisfies certain aspects of the VE and RR domains via didactic / laboratory / clinical experiences. Currently, we have established an IPE committee involving various faculty members from all of the professions listed above. This committee has developed a process to implement IPE in our University. This goal of our report is to describe the challenges to applying IPE in optometry, such as faculty development, curriculum modification and a timeline for implementing the IPE model.
CONCLUSIONS: Our model can be used as a platform for other optometric institutions considering IPE in their programs. This can be used as a starting point to expedite the process of employing IPE in their institution.
ADDITIONAL COMMENTS: None

18. **PRACTICAL GUIDELINES FOR FITTING BIOPTIC TELESCOPES** (125757)

Hendrik Peter Derksen, FAAO, Elvea Low Vision, Nijmegen The Netherlands

BACKGROUND: PURPOSE: To show the importance of the correct fitting of a Bioptic telescope to ensure the optimal results with the telescope while driving. A telescope helps the visual impaired driver see details such as signs and traffic signals. Bioptic does not imply two eyes; it means that the wearer has two optical systems, the spectacle (carrier) lens and the telescope. When extra magnification is needed the driver will briefly drop his head to view through the telescope for one or two seconds. The driver views 95% of the time by looking through the carrier or ground glass. History In 1958 William Feinbloom suggested for the first time the possibility of telescopes for driving while Korb in 1970 presented the first study. In 40 states of the USA people with moderately reduced visual acuity, (e.g. 20/50- 20/200) can legally drive with a small telescope fixed in a spectacle. In 2004 The Netherlands started a project that was based on training programs from the US and which were adapted into the driving and training assessments practices for The Netherlands. Since the 28th of April 2009 driving with a Bioptic telescope is legalized in The Netherlands as first country in Europe.
CASE REPORT(S): Material Spectacle mounted telescopes vary in power: 1.7 to 4X magnification. Viewing through the telescope shows a small area of 8-15 degrees. More power of the telescope means smaller field of view, and harder to use it. There are two types, Galilean and Keplerian. Galilean is useful to maximal 3 times magnification and Keplerian 7 times for driving. In The Netherlands only to 4 times magnification is permitted. Prescription is placed in ocular part of telescope. A telescope is focus able Keplerian or fixed focus like Galilean At work -Measure IPD corneal pupillometer -Telescope is placed for the monocular pupildistance at infinity -Telescope for dominant eye -Mark the horizontal and vertical line -Control cross in front of the eye -Glass Pad on the center of the cross -Pt. makes a small knot with the head -Angle telescope is pointed towards center of eye rotation -Penlite to see the pupil reflex -Frame is base for mounting angle -Control angle by modified protractor -Drill hole in carrier glass (N. 1.67) -Control stiff fitting and angle ~15 -Glue after final control -Control visual acuity (≥0.50)
CONCLUSIONS: Outcome: The success rate of the Bioptic telescope is fine tuning in the fitting procedure. Vertical space for frame is minimal 40 mm in height. Drilling must

at least 2 mm. from edge of the frame for structural strength. Optimal distance visual acuity ensures not always a success for driving with a telescope. A Bioptic is not a cure-all for being a safe driver. Training is absolutely essential. A Bioptic provides added information that increases the margin of safety while driving a vehicle. The Royal Visio offers a total and solid program for visual impaired people who would like to drive in a vehicle in The Netherlands. To cross borders in near future it would be interesting to pick up this subject for optometry in other European countries. For colleagues there is a challenge, the Dutch approach has shown that it is possible.

19. **RADIUS DEPENDENCE OF ZERNIKE POLYNOMIALS Z4 AND Z12 AND THE IMPACT ON CORNEAL TOPOGRAPHY (125939)**

Andreas Berke, School of Optometry, Cologne, Germany, Christoph Berke, Technical University, Dresden, Germany, Gustav Poeltner, University of Applied Sciences, Innsbruck, Austria

RESULTS: A decrease of the central aperture from 8.0 mm to 6.5 mm results in a diminution of Z12 from about 0.66 microns to 0.45 microns (32%) and an increase of the defocus Z4 from 2.29 microns to 3.15 microns (38%). Theory predicts a diminution of Z12 of 40% and increase of Z4 of 30%.
PURPOSE: To assess the radius dependence of Zernike Polynomials Z4 (defocus) and Z12 (spherical aberration) and their value for corneal topography.
METHODS: Ten patients (aged between 28 to 52 years) without any corneal abnormalities were fitted with scleral lenses with central apertures of 6.5 mm and 8.0 mm. The corneal topography was surveyed with the Keratograph 5 (Oculus, Dutenhofen Germany). The theoretical values of Z4 and Z12 were calculated for both radii and compared to the experimental data determined by the keratometer.
CONCLUSIONS: Zernike Polynomials are commonly used for the analysis of wave front aberrations, corneal topography and refraction. They represent a system of complete orthonormal functions. The completeness of this system is defined solely on the unit circle. Any minor radius is contradictory to the requirement of completeness and limits the use of Zernike Polynomials. Z12 and Z4 were chosen because they show no angle dependence and are solely radius dependent. A diminution of the radius decreases Z12 (spherical aberration) but causes an increase of defocus (Z4). Parts of the aberration Z12 are shifted to Z4. The depiction of deviations of a real surface from a reference surface is critically because the values of the individual Zernike coefficients dependent on the radius of the particular corneal zone.

20. **FRINGE PROJECTION TOPOGRAPHY: A NEW QUALITY IN THE MEASUREMENT OF ANTERIOR EYE SURFACE** (125006)

D. Robert Iskander, PhD, DSc, Institute of Biomedical Engineering and Instrumentation

RESULTS: In static position, the repeatability of instrument, based on 20 measurements in each case, was very high (standard deviation [SD] of the RMS error <0.03um) while the internal consistency was excellent (Cronbach's a=0.92). In dynamic case, when operator manually focussed the instrument, the repeatability and the intra-rater reliability was SD<1um and a=0.87, respectively. The inter-rater reliability (3 operators) was also

good (a=0.83). For test surfaces, the accuracy of the instrument in terms of RMS error was less than 10um but depended on the instrument-surface distance. The working DoF was estimated at +/-250um from the best focal plane. For real eyes, the largest coverage (extending, on average, up to 16mm horizontally and 12mm vertically was achieved with the more viscous solutions (0.2% or 0.4% hyaluronate sodium), which also enabled up to 20 measurements of the anterior eye surface without the need of fluorescein reapplication.
PURPOSE: To evaluate the clinical utility of a newly developed instrument for measuring the topography of the anterior eye surface.
METHODS: A fringe projection based eye surface profiler (ESP) is a new technology for measuring the anterior eye surface encompassing the corneoscleral area. It is an evolution of a wide field height eye topographer [OVS; 1998, 75:69-77]. Repeatability and reliability study was conducted on a series of test surfaces and real eyes. They included 3 spherical PMMA surfaces of radii 7.5mm to 8.5mm, a 6D toric surface, and a multi-curve shell resembling the anterior surface of a human eye. The ESP requires instillation of fluorescein. The effects of solution (saline, 0.2% and 0.4% hyaluronate sodium) used to moisten the fluorescein strips on the quality of a single and repeated measurements were evaluated.
CONCLUSIONS: The ESP has a potential to become an optometry clinical tool that could substitute the currently used videokeratoscopes and provide a new quality in those applications in which information on corneoscleral topography is of essence.
ADDITIONAL COMMENTS: Research grant from Eaglet-Eye, Netherlands

21. **THE LONG TERM EFFECT OF ARTIFICIAL TEARS (AT) ON CONTRAST SENSITIVITY AND HIGHER ORDER ABERRATIONS (HOA) IN DRY EYE (DE) SUBJECTS** (125002)
William H. Ridder, OD, PhD, FAAO, James O. LaMotte, PhD, OD, FAAO, Eric Borsting, OD, MS, FAAO, Rebecca Delshad, Southern California College of Optometry

RESULTS: The averaged CT (mean +/- SD) for the DE subjects were: 14.6 +/- 15.69, 15.1 +/- 16.02, and 12.4 +/- 13.13 for baseline, week 1, and 2, respectively. The averaged contrast thresholds for the normal subjects were: 4.6 +/- 2.10, 6.0 +/- 3.43, and 5.5 +/- 2.67 for baseline, week 1, and 2, respectively. An ANOVA found a significant difference across visits for CT for the DE subjects ($p = 0.007$, $F = 5.44$). A Tukey simultaneous test indicated that the CT for week 2 was significantly different from baseline ($p = 0.03$, $T = 2.56$). The averaged HOAs for the DE subjects were: 0.41 +/- 0.193, 0.43 +/- 0.185, and 0.39 +/- 0.163 for baseline, week 1, and 2, respectively. The averaged HOAs for the normal subjects were: 0.35 +/- 0.154, 0.33 +/- 0.123, and 0.34 +/- 0.119 for baseline, week 1, and 2, respectively. The HOA for the DE subjects did not change across visits ($p > 0.05$).
PURPOSE: A previous study of DE subjects indicated that using AT for 2 weeks resulted in a decrease in contrast thresholds. The purpose of this investigation was to increase the number of DE patients examined after 2 weeks of treatment with AT. Additionally, the effect of the AT on HOA was also examined.
METHODS: Thirty-one DE subjects and 20 normal subjects were examined. Subjects were characterized as having DE based upon the NEI DE workshop guidelines. Contrast

threshold (CT) was measured for a 14 cpd sine wave grating (16 ms duration) using a temporal, 2-AFC technique. Two CT measurements were made before daily AT use and at 1 and 2 weeks after daily AT use (minimum 2 times per day). The two measurements obtained at each visit were averaged for comparison across visits. The HOAs were measured with a VISX. The AT used was Refresh Optive (Allergan, Inc).
CONCLUSIONS: Treating DE subjects for 2 weeks with an AT resulted in a decrease in the CT but not the HOAs. A change in HOAs may not have been found because of the large variability in the data. The change in CT may be the result of the tear layer becoming more stable after 2 weeks of artificial tear use.

22. **COMPARISON OF ANTERIOR SURFACE ABERRATIONS BETWEEN SUBJECTS WITH CLINICALLY STABLE & UNSTABLE TEAR FILMS** (125122)

Natalie Hutchings, BSc, PhD, Varadharajan Jayakumar, BSOptom, Sruthi Srinivasan, PhD, BSOptom, FAAO, Trusit Dave, Nancy J. Keir, OD, PhD, FAAO, Lyndon W. Jones, PhD, FCOptom, FAAO, University of Waterloo Centre for Contact Lens Research

RESULTS: There was no significant difference in target area between primary position, 10° and 20° head turn overall or between groups (RM-ANOVA; all p>0.05). The unstable tear film group showed higher measurement variability with CL than the stable group (MnRMS; Unstable:0.196; Stable:0.075). An increase in RMS HOA in the inter-blink epoch was evident in the unstable tear film group that was, on average, 4x higher than the stable tear film group, with and without contact lenses.
PURPOSE: To characterize and compare anterior surface aberrations in subjects with clinically stable and unstable tear films.
METHODS: The sample comprised 6 subjects (mean age±SD: 26.0±5.9; 5 female) with clinically stable tear film and 6 subjects (mean age±SD: 34.5±10.3; 5 female) with clinically unstable tear film. Stability was defined using non-invasive tear break-up time (NITBUT; Stable: Mean >8s; Unstable: Mean <5.3s) and wettability of habitual contact lenses (CLW; Stable: Mean <1; Unstable: Mean >2.5). Anterior surface aberration measurements were obtained with the Topcon CA100F. Each acquisition comprised ~45s of continuous measurement (4Hz) with forced blinking every 8s. Raw RMS higher order aberration (RMS HOA) data were smoothed using a running mean, and a running SD was derived to describe variability over time (caTools1, R Statistical Software). Measures were obtained with and without contact lenses and for primary position, 10° and 20° head turn. The different head positions were used to determine if an increase in target area could be obtained.
CONCLUSIONS: Subjects with clinically unstable tear films exhibited greater variation in RMS HOA over time and a trend of increasing RMS HOA in the inter-blink interval than subjects with a stable tear film.
ADDITIONAL COMMENTS: Commercial financial support from Alcon, Fort Worth, Texas, USA.

23. **CORNEAL THICKNESS AND VOLUME IN SUBCLINICAL AND CLINICAL KERATOCONUS** (125070)

Seyed Mahdi Ahmadi Hosseini, MOptom, Fereshteh Abolbashari, Norhani Mohidin, Bariah Mohamad Ali, Iran

RESULTS: Subjects comprised 32 mild to moderate clinical keratoconus, 15 subclinical keratoconus and 52 normal eyes. Our results indicated CT distribution, PTI and CV were significantly different in normal compare to subclinical and clinical keratoconus (P<.05). Overall subclinical group showed less CT distribution and volume, and more PTI compare to normal. In contrast, they showed more CT distribution and volume, and less PTI compare to keratoconus group. In addition, from thinnest point of the cornea to periphery we faced to less change in the PCT and PTI.
PURPOSE: To compare the corneal thickness and volume in subclinical and clinical keratoconus of Asian population in order to better discrimination between normal and ectatic cornea.
METHODS: Eyes were placed into one of the following group according to our patient grouping criteria: normal, subclinical and mild-moderate keratoconus. Pentacam Scheimpflug imaging (Oculus Inc., Wetzlar, Germany) was performed for the subject to record thinnest corneal thickness, central corneal thickness, corneal thickness (CT) and percentage thickness increase (PTI) at 2, 4, 6 and 8 mm and corneal volume (CV). Then data were exported to SPSS for statistical analysis.
CONCLUSIONS: To the best of our knowledge, this is the first study that record the CT distribution and CV profile in subclinical and clinical keratoconus of Asian population. The results indicated that CT parameters and CV were significantly different in normal versus subclinical and normal versus keratoconus. These findings can help clinicians to better discriminate between normal and ecstatic cornea.

24. **COMPUTER-AIDED ANALYSIS OF TEAR FILM VELOCITY COMPARED WITH ESTABLISHED TEAR FILM TESTS** (125575)

Joerg Kuntz, BSc, Martina Michel, Wolfgang Sickenberger, MS Optom, Dipl Ing (FH) AO, Ernst Abbe University of Applied Sciences

RESULTS: The median of the tear film velocity assessed with the slit lamp was 1.15mm/s (mean 1.24+/-0.47mm/s), this assessed with the topographer was 1.19mm/s(mean 1.10+/-0.39mm/s). The results were normally distributed(Shapiro-Wilk-test) with both slit lamp (p=0.216) and topographer method (p=0.365). No significant difference between the methods (p=0.113; t-test; 95%CI(of differences) -0.34;-0.31mm/s) was found and the results correlated (r=0.347, p=0.044). However, no significant correlations between the velocities and established tear film tests were identified (p>0.05)
PURPOSE: To compare the tear film velocity measured in a manual analysis by means of a slit lamp with computer-aided analysis using a corneal topographer. These measurements of the tear flow behavior will be performed automatically. Correlations between the flow rates and established tear film tests were also carried out.
METHODS: A conventional slit lamp and a previously modified corneal topographer (Keratograph 4) was used to assess tear film velocity. The velocity of tear film particles of 34 participants (right and left eye; mean age 37.1+/-19.1years; male 38% female 62%) were recorded in a video. The velocity after 1 second was used for statistical analysis. The tear film velocity corresponds to the movement of these particles. Using the VIANA

video analysis software, the velocity was analyzed automatically. The velocities measured with slit lamp were compared with those of the topographer (Pearson). Moreover, the correlation between the results of established tear film tests (tear meniscus height, lipid interference pattern, Phenol red test) and the velocities were determined (Spearman)
CONCLUSIONS: Modified topographer allows a user-friendly assessment of tear film velocity. A correlation between flow rates and established tests could not be detected. Further studies should be made to carry out and develop an automatically detection of particles and a classification of tear film velocity
ADDITIONAL COMMENTS: The Keratograph 4 and was provided by Oculus GmbH. This study was accomplished without any financial support.

25. OPTIMIZATION OF THE NON-CONTACT MEIBOGRAPHY BY MEANS OF AN EXPERIMENTAL CORNEAL TOPOGRAPHER (125663)

Martina Michel, Wolfgang Sickenberger, MS Optom, Dipl Ing (FH) AO, Ernst Abbe University of Applied Sciences

RESULTS: The modifications tested were implemented in a new device (Keratograph 5M, Oculus). With this device, the assessment of the meibomian glands is possible with an adequate field of view of 25mm. The greater working distance facilitates the eversion of the eyelid. Due to the high resolution camera, high-quality photos and videos can be taken. Six vertically arranged IR-diodes with a wavelength of 840nm ensure a uniform illumination.
PURPOSE: To optimize the non-contact meibography using a corneal topographer to improve the image quality and to make the assessment of the meibomian gland morphology more accessible in daily practice, easier for the practitioner and more comfortable for the patient.
METHODS: A commercial corneal topographer was used to assess meibography images regarding illumination, magnification and field of view. With lenses which were adjusted in the calotte of the device the field of view, the optimal magnification and in this regard an appropriate working distance were determined to simplify the gland assessment for the investigator in terms of the eversion of the eyelid. With an experimental corneal topographer equipped with a high resolution camera and a manually adjustable magnification changer, the illumination was tested. Therefore, different IR-diodes with seven different wavelengths were tested as well as the number and the arrangement of the diodes were determined to achieve a good uniform illumination on the entire area of the everted eyelid. In addition, some software settings regarding white balance, exposure time and gain were optimized.
CONCLUSIONS: The morphology of the meibomian glands can be examined with the new device in an investigator and patient-friendly way. The excellent quality of the meibography images simplifies the evaluation of morphologic gland changes.

26. BICENTRAL, PROSPECTIVE STUDY TO COMPARE CORNEAL DIAMETER, CURVATURE AND ECCENTRICITY OF CAUCASIAN EYES (125656)

Claudia K. Blaurock, BSc, Daniela Oehring, BSc, Wolfgang Sickenberger, Prof MS Optom (USA), Dipl Ing (FH) AO, Ernst Abbe University of Applied Sciences

RESULTS: Between the corneal diameter (11.74+/-0.40mm), flat and steep corneal radius of curvature (7.86 +/- 0.28mm; 7.67 +/- 0.27mm), a small correlation (r=0.470; R2=0.221; p=0.000; r=0.477; R2=0.228; p=0.000) was determined. The results within the groups sex, age and eye side (p>0.005) were equivalent. The correlation between the flat and steep radius of curvature (7.86 +/- 0.28mm; 7.67+/-0.27mm) and the overall eccentricity (0.54 +/- 0.12) at 30DEG is: r=0.125; R2=0.016; p=0.000; r=0.092; R2=0.008; p=0.000. 51.2% of all data analyzed are located in the range of (11.34; 12.14)mm on the x-axis (corneal diameter) and (7.85; 8.14)mm at the y-axis (flat corneal radius of curvature).
PURPOSE: To review the following hypothesis: the larger the corneal diameter the smaller the corneal curvature. Furthermore, the relationship between the corneal parameters which are important for soft contact lens fitting will be examined.
METHODS: In this retrospective study, 5827 data from right (52%) and left (48%) Caucasian eyes were analyzed. These data were exclusively taken from the Oculus Keratograph 4, which were collected in two different German locations (Jena n=1688 and Hildesheim n=4139) and saved from July 1999 to March 2012. 66% females and 34% males with an average age of (33.8; 14.2) years were included. Correlations were analyzed with Pearson coefficient. The following correlations were examined: corneal diameter, radii of corneal curvature and corneal eccentricity at 30DEG. Furthermore, the data were analyzed within the following groups: sex, age, eye side.
CONCLUSIONS: The hypothesis the larger the corneal diameter the smaller the corneal curvature was proven and confirmed. Eyes with a flatter radius of curvature tend to have a higher eccentricity at 30DEG. The design of soft contact lenses referring to average values of corneal parameters leads to approx. 50% suitable contact lens geometries for contact lens wearers.
ADDITIONAL COMMENTS: This study was accomplished without any financial support.

27. **PROSPECTIVE STUDY TO ESTABLISH THE STANDARD VALUE OF TEAR FILM OSMOLARITY OF EYE-HEALTHY, ASYMPTOMATIC SUBJECTS** (125074)

Daniela Oehring, BSc, Wolfgang Sickenberger, Prof MS Optom (USA), Dipl Ing (FH) AO, Ernst Abbe University of Applied Sciences

RESULTS: The mean osmolarity was determined at (303.3+/-17.3)mOsms/L. The osmolarity of right eye (304.9+/-18,2)mOsms/L was statistically significantly higher than of left eye (301.6+/-16.3)mOsms/L (t-test paired samples p=0.020) but not clinically relevant. When the osmolarity of only one eye is measured and the recommended Cut-Off-Value of 316mOsms/L was used to diagnose dry eye, the sensitivity of the test decreased from approx.. 95% to 61.6%. The mean osmolarity determined correlates with the value calculated in the meta-analysis (303.5+/-6.3mOsms/L , n=1463; t-test, unpaired samples p=0.901 reverse null hypothesis).
PURPOSE: To determine the standard value of tear osmolarity among eye-healthy,

asymptomatic participants using TearLab Osmometer (TearLab Corporation) and to compare this value with past studies.
METHODS: In this prospective, randomized (eye side, used measured pen) clinical trial, 304 participants from 8 different German regions were included. Data were collected at 1 visit. After baseline examination, 134 participants (56 male/78 female; average age 40.9, 15.9years) met the inclusion criteria. Participants using medication for regulation of water/electrolyte balance and medication which influenced tear production or tear film were excluded. The McMonnies DEQ was used to detect dry eye disease. A meta-analysis was conducted using 21 studies which examined asymptomatic participants fulfilling pre-defined criteria such as medication use or defined age of participants.
CONCLUSIONS: The mean osmolarity that was determined in this study may be used as representative for an asymptomatic patient. Measurement of osmolarity should be performed under stable laboratory conditions. When using the COV of 316 mOsms/L, the measurement of only one eye is not sufficient to make an exact diagnosis. It is indispensable to measure both eyes in order to diagnose dry eye disease.
ADDITIONAL COMMENTS: The TearLab Osmometer and equipment was provided by Ciba Vision Vertriebs GmbH and slit lamp by BonOptic GmbH. This study was accomplished without any financial support.

28. GAZE DIRECTION HAS NO SIGNIFICANT EFFECT ON THE PHENOL RED THREAD TEST (125617)

J. Peter Gierow, PhD, FAAO, Jessica Pettersson, BSc, Linnaeus University

RESULTS: 16 of the 30 patients (53.3 %) had a higher result with downward gaze compared with forward and 10 (33.3 %) a lower value while four (13.3 %) had the same result for these two directions. Up-ward gaze resulted in a higher result than forward in 13 patients (43.3 %), 16 (53.3 %) had a lower value and one (3.33 %) had the same result for these two directions. Students t-test showed no significant difference between any of the directions ($p > 0.05$). Normalizing brought the p-values closer to significance (forward vs. down-ward $p = 0.067$; inferior gaze vs. forward $p = 0.073$).
PURPOSE: Dry eye disorders are becoming more common as the population is getting older making it more and more important to have standardized, reliable and fast diagnostic methods. One test alone is not enough for this, often a combination of different tests are necessary. In a study of Korb (2000) it was found that the most frequently used test was patient history followed by tear film break-up time, fluorescein staining and in fourth place Rose Bengal staining. Measurements of tear flow/volume did not rank high and some participants expressed frustration over the lack of standardization. One issue is the direction of gaze when performing tests of tear production/volume. Recently, Bitton et al (2011) investigated the effect of different directions of gaze on the Schirmer test, showing that down-ward gaze results in significantly higher values. In the present study, a similar study was undertaken to investigate to effects of gaze direction on the Phenol Red Thread test.
METHODS: 30 healthy patients participated in the study, and each one was subjected to the phenol red thread test keeping their gaze in three directions, straight forward, 20

degrees up-ward and 20 degrees down-ward. The order of the gaze direction was alternated, so that each direction was tested first, last or in between equally.
CONCLUSIONS: No significant differences were found between different gaze directions, but a tendency towards higher values were obtained with a down-ward gaze.

29. **AGE RELATED ANTEROPLACEMENT OF THE LINE OF MARX AND CONTACT LENS WEAR** (125380)

Samuel Kim, OD, Caroline A Blackie, OD, PhD, FAAO, TearScience, Donald R. Korb, OD, FAAO, Boston, MA

RESULTS: There is a statistically significant linear relationship between anteroplacement of the LOM and age in all three categories: noncontact lens wearers: r2 = 0.16, p<0.0001; soft contact lens wearers: r2 = 0.08, p = 0.0003; hard contact lens wearers: r2 = 0.08, p = 0.0003. The relative frequencies of LOM score (e.g. 0, 1 or 2) were not significantly different between the three categories of non contact lens wear, soft and hard contact lens wear (p = 0.07).
PURPOSE: The goal of this study was to evaluate the relationship between age, and contact lens wear and anteroplacement of the Line of Marx (LOM).
METHODS: 403 subjects, recruited from routine eye examinations were enrolled and consented according to the tenet of the Declaration of Helsinki (age range: 9 - 80 yrs, mean: 49.8, 16.1 yrs). The sample included subjects from three categories: Non-contact lens wearers, n = 163, soft contact lens wearers, n = 156, and hard contact lens wearers, n = 84. To evaluate the position of the LOM a 25 microliter drop mixture of 2% liquid non-preserved fluorescein (B&L, Chauvin, France) and 1 % lissamine green (Pfaltz & Bauer, CT, USA) was placed in the inferior cul-de-sac of each eye using a transfer pipette. After 90 seconds, the LOM was evaluated and scored according to the following: LOM is mostly posterior to the orifices (> 75%) = 0; mostly bisecting = 1; mixed posterior and bisecting = 1; mostly anterior = 2; mixed posterior; bisecting and anterior = 2; mixed bisecting and anterior = 2. One examiner performed all of the evaluations. Only data for right eyes is reported.
CONCLUSIONS: This is the first report to document the distribution of relationship between the LOM, age and hard and soft contact lens. Remarkably, there was no significant difference in the amount of anteroplacement of the LOM for the groups: non contact lens wearers and hard and soft contact lens wearers.

30. **DEBRIDEMENT OF LOWER LID MARGIN AND LINE OF MARX IS EFFECTIVE IN INCREASING MEIBOMIAN GLAND FUNCTIONALITY AND PATIENT COMFORT** (125412)

Donald R. Korb, OD, FAAO, Boston, MA, Caroline Blackie, OD, PhD, FAAO, TearScience

RESULTS: There was a significant decrease in symptoms and increase in the number of functional meibomian glands as a result of the debridement. Symptoms: mean pre debridement = 13.7 +/- 4.5 and 1 month post = 10.1 +/- 2.4 (p = 0.003, paired t-test). Number of functional meibomian glands: mean pre debridement = 3.0 +/- 1.2 and 1 month post = 4.2 +/- 1.3 (p = 0.005, paired t-test).

PURPOSE: The purpose of this pilot study was to evaluate whether mechanical debridement of the Line of Marx and the lower lid margin would improve meibomian gland functionality and reduce dry eye symptoms.
METHODS: 10 symptomatic subjects who were undergoing treatment for evaporative dry eye (age range: 37-81 yrs, mean: 56.3 +/- 15.2 yrs) who also evidenced anteroplacement and an increase in the width of the Line of Marx 0.5 mm, were enrolled and consented according to the tenets of the Declaration of Helsinki. The lower lid margins and the Line of Marx were debrided with a stainless steel, foreign body, golf club spud (Akorn Ophthalmics, IL). Meibomian gland function and symptoms were assessed pre and approximately 1-month post lid debridement. Meibomian gland function was evaluated along the full length of the lower lid margin with the meibomian gland evaluator. Symptoms were evaluated with the SPEED questionnaire (maximum score = 28). Only data for the right eye is reported.
CONCLUSIONS: This is the first report of debridement of the lower lid margins and the Line of Marx for anteroplacement and increase in width of the Line of Marx. The results suggest that lower lid margin and Line of Marx debridement should be given further consideration in the context of age related lid margin changes, meibomian gland dysfunction and dry eye symptoms.

31. **MEASURING TEAR TURNOVER RATES BY MONITORING FLUORESCEIN DE-QUENCHING** (125674)

Linda Venezia, Carolyn G. Begley, OD, MS, FAAO, Ping Situ, MB, PhD, Ziwei Wu, Elisha Cain, Adam Winkeler, OD, Jun Zhang, Indiana University School of Optometry

RESULTS: The means+/-SD of TMF for the cornea were 2.68+/-1.90 and 3.61+/-2.55 for 4% and 6% FL respectively, and 2.15+/-2.02 and 2.96+/-2.55 for 4% and 6% FL of ITM, respectively. There were significant differences in TMF between the cornea and ITM (ANOVA $p=0.04$) while the differences between 4% and 6% FL concentration was approaching statistical significance ($p=0.05$). The TMF for the cornea was correlated with that of the ITM regardless of FL concentrations ($r=0.71$ and 0.54 for 4% and 6%, respectively, $p<0.05$). TMF of ITM with 4% FL was correlated with age ($r=0.53$, $p<0.05$).
PURPOSE: Tear clearance measures the rate of disappearance of 2% fluorescein (FL) over 30 mins with several insertions of Schirmer tear strips to obtain tear turnover rates (TTR). The purpose of this pilot study was to develop a novel technique for measuring TTR within 5 mins using the FL concentration quenching.
METHODS: 20 subjects (16 dry and 4 non-dry eye, age 39+/-8.39 years) were enrolled in this study. The Dry Eye Questionnaire and Current Symptom Questionnaire were used to assess ocular symptoms over the past week and at each visit day. Tear film break-up time, Schirmer tear test and ocular surface staining were evaluated at baseline. Video slit-lamp images were captured for 5 mins, following instillation of 1 microliter of 4% or 6% FL on two separate days (test eye and the order of FL concentration randomly determined). For each FL concentration, images of FL intensity of cornea and inferior tear meniscus (ITM) were graded on a scale of 0 (dark, no fluorescence) to 5 (maximum fluorescence). The time required for the corneal tear film and inferior tear meniscus to

reach maximum fluorescence (TMF) was used for data analysis.
CONCLUSIONS: This pilot study suggests that either 4% or 6% FL can be monitored in the ITM or cornea, but 4% in the ITM is the fastest. The time required to dequench FL by instilling higher concentrations may be a more clinically useful and less invasive measurement of TTR than the current technique of tear clearance.

32. **MANAGEMENT OF CORNEAL EROSION SECONDARY TO STAPHYLOCOCCUS AUREUS CORNEAL INFECTION IN A NON-CONTACT LENS WEARER** (125208)

Paul Raymond Mayo, OD, MS, FAAO, Naval Hospital, Yokosuka, Japan

BACKGROUND: While corneal erosion secondary to the release of alpha-toxin in S. aureus corneal infection has been previously reported in the scientific literature, there is deficient instruction on the management of this condition in both the literature and clinical references. The following case report details the management of a corneal erosion as a complication of a S. aureus corneal infection in a non-contact lens wearer.
CASE REPORT(S): A 37 year-old US Navy active-duty service member presented with a red painful photophobic OS for 2 days, a recent medical history of sore throat, and no recent history of ocular trauma. The patient was prescribed topical ciprofloxacin eye drops and artificial tears by his PCP on the day prior to initial presentation but reported no improvement. Initial exam was remarkable for a 0.5 mm peripheral anterior stromal infiltrate OS with no overlying epithelial defect, an adjacent linear corneal abrasion immediately inferior to the infiltrate, 3+ bulbar conjunctival injection, 2+ palpebral follicles, trace anterior chamber cell response, and a palpable left-sided submandibular node. Medical treatment was changed to topical moxifloxacin hourly while awake and oral ibuprofen. The patient showed no improvement on day 2 and treatment with oral acyclovir was begun as HSK infection could not be ruled-out. On day 3, the patient presented with a corneal erosion emanating from the location of the previous abrasion that required debridement of over 80% of his central corneal epithelium. Corneal and conjunctival cultures and sensitivities were positive for MRSA infection. The patient was fit with a bandage soft contact lens (BSCL) and continued on topical vigamox and oral acyclovir. The BSCL was successfully removed on day 7 and topical prednisolone acetate therapy was begun on day 9 to reduce inflammation and minimize scarring.
CONCLUSIONS: Corneal erosion secondary to S. aureus corneal infection is easily managed with bandage soft contact lens, frequent follow-up and appropriate topical antibiotic coverage.

33. **ASSESSING THE VALIDITY OF THE OCULAR SURFACE DISEASE INDEX USING THE SCHEIN QUESTIONNAIRE AND CISS** (125456)

Annie Chang, OD, FAAO, Eric Borsting, OD, MS, FAAO, William H. Ridder, OD, PhD, FAAO, Jerry R. Paugh, OD, PhD, FAAO, Southern California College of Optometry

RESULTS: The mean OSDI score for the dry eye group was 13.9 (9.7) and the normal group was 8.3 (8.1). This was significantly different using a two sample t-test ($p=0.025$). The Pearson correlations between all the surveys were significant ($p<.001$). The OSDI has a very high correlation with the Schein Dry Eye Questionnaire ($r=0.75$) and a

moderate correlation with the CISS (r= 0.47). Additionally, the Schein Dry Eye Questionnaire showed a high correlation with the CISS (r=0.57).
PURPOSE: We previously reported that adults with dry eye and symptoms related to dryness as measured by the OSDI also report more frequent reading related symptoms as measured by the Convergence Insufficiency Symptom Survey (CISS). The purpose of this study was to assess the validity of the Ocular Surface Disease Index (OSDI) using a dry eye specific survey (Schein Dry Eye Questionnaire), and non-dry eye specific survey (Convergence Insufficiency Symptom Survey-CISS) in adults with and without dry eye.
METHODS: Thirty-eight subjects ages 23 to 64 (mean = 39, SD = 15.5) were screened for dry eye based on criteria originally suggested by the National Eye Institute (NEI)/Industry workshop guidelines and symptom score for the Schein Dry Eye Questionnaire. All subjects had visual acuity of 20/25 or better at distance and near and were without binocular dysfunction. Twenty subjects ages 21 to 62 (mean = 32, SD = 12.2) who did not meet the criteria for dry eye served as a normal group. All subjects completed the OSDI, Schein Dry Eye Questionnaire and the CISS at the same visit. The total score for each survey based on assigning point values to each response category was used for the analysis.
CONCLUSIONS: This study confirms that the OSDI is a valid instrument for assessing adults with dry eye. The significant correlation with the CISS indicates that the adults with dry eye have symptoms similar to those with convergence insufficiency.
ADDITIONAL COMMENTS: This study was supported by an unrestricted grant from Allergan.

34. THERAPEUTIC EFFECT OF FREQUENT USE OF DRY EYE SOLUTIONS IN SUBJECTS EXPOSED TO ENVIRONMENTAL STRESS CONDITIONS (125517)

Alan Tomlinson, MSc, PhD, FAAO, Louise Madden, PhD, MOptom, Glasgow Caledonian University, School of Health and Life Sciences, Peter Simmons, PhD, Allergan LLC

RESULTS: Statistical analyses were by General Linear Models repeated measures ANOVAs. Significant changes ($p < 0.05$) were found after treatment for: tear evaporation (reduced with solution B in normals and solutions A, B and C in dry eye); improved symptoms (for B and C in normals and all solutions for dry eye); increased TBUT (all solutions in dry eye) and lowered osmolarity (solution A for normal and all solutions for dry eye). Significant differences in the relative effectiveness of the different treatments were found only for changes in tear evaporation rate; evaporation decrease was greater with B compared to A and with C compared to A (the change (decrease) with B compared to C was significant at the 10% level).
PURPOSE: To determine the effects of the sustained use of 3 solutions on the tear physiology of normal and dry eye patients under conditions of environmental stress.
METHODS: The effects on the tear physiology of normal and dry eye patients of 2 weeks treatment by one of three solutions was evaluated in a 3 arm crossover study. Nineteen normal and 18 dry eye patients completed the study with the solutions A-C (A = Refresh Contacts, B = Refresh Optive(TM) Advanced, C = Refresh Ultra- Allergan Inc.) randomly assigned 6 treatment sequences. Measures of tear evaporation rate (the

principal outcome measure), break up time (TBUT), osmolarity, and structure (by interferometry), as well as patient symptoms were recorded at baseline and at 2 weeks post therapy. All measures were carried out after 10 minutes of patient adaptation to environmental conditions of 72F and at a controlled relative humidity level of 20% (a condition of environmental stress).
CONCLUSIONS: The new emulsion (Refresh Optive Advanced)performed best overall in this clinical trial reducing symptoms, tear evaporation, and osmolarity and increasing TBUT in dry eye patients; it produced a greater treatment effect than the other test solutions.
ADDITIONAL COMMENTS: Supported by an unrestricted research grant from Allergan Inc

35. **CAN TOPICAL DRY EYE TREATMENT IMPROVE SIMULATED DRIVING PERFORMANCE?** (125437)
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RESULTS: Paired-comparison t tests were performed for those data exhibiting normal distribution. Non-normal distributions were compared using the Wilcoxon Signed Rank test. Dry eye symptoms were significantly reduced in the active treatment compared to saline ($p=0.0020$). Schirmer strip wetting and tear film break-up time were significantly improved in treatment ($p=0.0038$ and 0.0008, respectively). Corneal fluorescein staining, conjunctival lissamine green staining, and meibomian gland score were reduced ($p<0.0001$ in each case). Key variables relating to driving precision, accident avoidance, and reaction times were similarly analyzed. A trend of improved driving performance in the active treatment was not statistically significant and near collisions were less frequent ($p=0.0172$).
PURPOSE: To test an active topical dry eye treatment (Systane®Balance, Alcon Laboratories; Ft. Worth TX) for impact on the simulated driving performance in mild or moderate dry eye compared to a topical saline (Sensitive Eyes®, Bausch & Lomb; Rochester NY). Dry eye symptoms and signs were also assessed.
METHODS: Forty human subjects with symptomatic mild or moderate dry eye completed a double-masked crossover study. Subjects were sorted randomly into groups that began instilling active treatment or saline 3 times per day for 30 days. Two-week washout periods with saline were placed before and between the 30-day test periods. A questionnaire, battery of clinical eye tests, and driving simulation (STISIM Drive®, Systems Technology; Hawthorne CA) were administered at baseline, after the first test period, and after the crossover. Simulation of night driving with fog and glare including air flow out of dash vents was selected to challenge dry eye subjects.
CONCLUSIONS: Symptoms and signs were improved when using the active topical treatment in mild and moderate dry eye compared to saline. A trend of improved simulated driving performance with the active treatment was not statistically supportable. Further study may be needed to improve the correlation of clinical assessments and visual task performance.

36. **THE EFFECT OF A NEW LIPID-BASED EYE DROP ON TEAR EVAPORATION RATE AND COMFORT** (125520)

Cecile A. Maissa, PhD, Michel Guillon, FAAO, Benjamin Bossard, Nathalie Hauet-Richer, PhD, Optometric Technology Group

RESULTS: 33 (132 data points) out of 40 enrolled subjects had valid castor oil data. At both visits combined, a detectable amount of castor oil in the tear samples was associated with a lower evaporation rate at 30% RH (27.2 vs. 32.3; p=0.046) but a similar comfort (72.2 vs. 71.5; p=0.856) than when castor oil was not detected. Prior to eye drop instillation at Day 30, when castor oil was present in the tear samples, the evaporation rate was lower at both 30% RH (27.3 vs. 32.4; p=0.028) and 40% RH (25.5 vs. 30.5; p=0.047) than at baseline. Finally, comfort was significantly better after 30 day use of the eyedrops (70.9 vs. 48.9; p<0.002).

PURPOSE: A new lipid-based eye drop has been designed to deliver lipid (castor oil) and water to the eye along with the established lubricant carboxymethylcellulose, in order to replenish deficient aqueous and lipid components. A previous study has shown that its usage produced a significant increase in the concentration of castor oil in the tear film up to 3 hours. The objective of this follow-up study was to evaluate the effect of castor oil supplementation on the tear film evaporation rate and comfort.

METHODS: The study was a prospective bilateral evaluation of evaporative dry eye sufferers using the lipid-based eyedrops (Refresh Optive™; Advanced, Allergan) for one month. Two study visits (Baseline & Day 30), each involving one eye drop instillation and a follow-up for 120 minutes, took place. The presence of castor oil in 2ul of non-reflex tears was monitored by HPLC; tear film evaporation rate (in 10-7g/cm2/sec) was measured at low (30%) and normal (40%) humidity and subjective comfort was evaluated on a 0 to 100 VAS scale.

CONCLUSIONS: The supplementation of the native tear lipids with an eye drop containing castor oil along with demulcents was shown to be associated with a reduction in the tear film evaporation rate and an increase in ocular comfort. Castor oil was detected in basal tear after 30 day supplementation suggesting a long term interaction with the native lipids.

37. **THE MANY OFF-LABEL USES OF TOPICAL OPHTHALMIC CYCLOSPORINE 0.05% EMULSION** (125951)

Nicholas Colatrella, OD, FAAO, Sartell, MN, Jeffrey R. Varanelli, OD, FAAO, Warren, MI, Stacy M. Hinkemeyer, OD, FAAO, Sartell, MN, Jeanette C Varanelli, OD, FAAO, Detroit, MI

BACKGROUND: Topical ophthalmic cyclosporine 0.05% emulsion (Restasis; Allergan,Inc.) was approved by the US Food and Drug Administration for the treatment of dry eye and ocular surface inflammation. It has also been shown to block angiogenic factors induced by VEGF and inhibit various immune responses, including immunologic rejection of foreign tissue. It therefore has the potential to be used in other treatment modalities outside of dry eye and should be considered when appropriate.

CASE REPORT(S): This poster will focus on the many different off-label indications for using topical cyclosporine, and present case reports to highlight a few of the more

common conditions. We will also present an in-depth literature review covering the different applications. And will further discuss when to use topical cyclosporine off-label, along with dosing recommendations and typical follow up. Topical cyclosporine has successfully been used off-label to treat: herpes simplex stromal keratitis, allergic conjunctivitis, sclerokeratitis, ocular graft vs host disease, recurrent corneal erosions, adenoviral keratoconjuctivitis, vernal keratoconjuctivitis, Thygeson's SPK, MGD, atopic keratoconjunctivitis, pre-operative Lasik, transient light sensitivity syndrome, penetrating keratoplasty, and pterygium removal.
CONCLUSIONS: Topical cyclosporine 0.05% is safe for long-term use and does not show the side effect potential that other anti-inflammatory medications elicit. Several clinical studies demonstrated that topical cyclosporine 0.05% is well tolerated, with most adverse events being transient in nature and only mild to moderate in severity, and therefore should be considered as an alternative treatment option when appropriate.

38. **THE USE OF PLATELET-RICH PLASMA FOR THE TREATMENT OF SEVERE AND MILD OCULAR SURFACE DISEASE** (125970)
Edward S. Jarka, OD, MS, University of Missouri-St. Louis School of Optometry

BACKGROUND: The use of Autologous Serum for the treatment of severe ocular surface disease (OSD) has been established. Platelet-rich plasma (PRP) has also been shown useful. We report two cases of severe and mild severity treated with 30% PRP concentrate. We also offer a hypothesis for the observed results that suggests a change in biotensegrity within the ocular surface tissue may be responsible for the results.
CASE REPORT(S): Case #1: A 74 year-old woman with a 3 year history of severe dry eye with significant clinical signs and quality of life reduction including constant photophobia and loss of outdoor hobbies. Previous treatment included Restasis, Azasite, fish oil supplements, artificial tears and ointment. She was treated with 30% PRP concentrate twice a day. In addition all of her topical medications were discontinued. After 3 weeks she noted some improvement and after 8 weeks she was able to return to her outdoor hobbies. She returned to soft contact lens wear and has remained free of discomfort after discontinuing the PRP. Case #2: A 26 year-old optometric student with complaints of a significant reduction in the wearing time of her soft contact lenses. Changes in lens material and care system were unsuccessful. She agreed to treatment of 30% concentrate of PRP. In 3 weeks she noted improved contact lens comfort and in 6 weeks she was able to increase her wear time from 4-6 hours to 12 hours or more.
CONCLUSIONS: Platelet-rich plasma may have a significant place in the treatment of severe and mild dry eyes. We offer a hypothesis suggesting that the multiple growth factors in PRP result in an improvement in the biotensegrity of the ocular surface reslting in a longterm reduction in the chronic inflammation which initiated the signs and symptoms observed in these very differnt forms of dry eye.

39. **EFFICACY OF LOTEPREDNOL ETABONATE GEL, 0.5% IN THE TREATMENT OF INFLAMMATION IN POST-CATARACT SURGERY PATIENTS** (125303)
Timothy L. Comstock, OD, MS, FAAO, Raphaele Siou-Mermet, MD, Tara Erb, MS, Tuyen Ong, MD, Bausch+Lomb Inc.

RESULTS: The integrated ITT population consisted of 813 patients (n=409 LE gel, n=404 vehicle). The proportion of patients with resolution of ACC, resolution of flare, resolution of both ACC and flare, and Grade 0 (no) pain was significantly greater (P>0.001) in the LE gel group compared with the vehicle group at all postoperative visits except Day 3 for ACC (P=0.291) and ACC and flare combined (P=0.338). On days 3, 8, 15 & 18, respectively; resolution (%) of ACC was 6.1 vs. 4.5, 30.8 vs. 15.1, 53.3 vs. 26.0, 51.3 vs. 25.7; resolution (%) of flare 45.5 vs. 32.2, 66.5 vs. 36.6, 76.5 vs. 41.1, 64.1 vs. 32.9; resolution (%) of ACC & flare was 5.4 vs. 4.0, 30.1 vs. 13.9, 52.8 vs. 25.0, 51.1 vs. 25.2; and resolution of pain (%) was 71.4 vs. 46.8, 74.3 vs. 43.8, 76.8 vs. 41.1, 66.5 vs. 32.9, in the LE gel vs vehicle groups, respectively.
PURPOSE: Loteprednol etabonate gel, 0.5% (LE gel) is a new non-settling formulation of LE with a pH closer to physiologic and a lower concentration of benzalkonium chloride (0.003%). The non-settling gel formulation delivers consistent dose uniformity without the need to shake. LE gel was effective in resolving anterior chamber cells (ACC) at postoperative Day 8 in two multicenter, double-masked, vehicle-controlled studies in patients following uncomplicated cataract surgery. We report outcomes for ACC, flare (individually and combined), and pain at all visits integrated across these two studies.
METHODS: In each study, patients aged ≥ 18 years with postoperative anterior chamber cell (ACC) ≥Grade 2 after cataract surgery were randomized to LE gel or vehicle QID for 14 days. Resolution of ACC, resolution of flare, resolution of both ACC and flare, and Grade 0 (no) pain were assessed on postoperative Days 3, 8, 15 and 18. Efficacy data were pooled across studies, and between treatment differences analyzed.
CONCLUSIONS: LE gel was effective in resolving ocular inflammation and pain in post-cataract surgery patients in these studies.

40. **APPLICATION TECHNIQUES AND IOP CHANGES WITH A PROSTAGLANDIN USED FOR LASH GROWTH** (125455)

Lindsey A Bull, OD, Northeastern State University Oklahoma College of Optometry, Michael Gaydos, United States Air Force, Wichita Falls, KS, Latricia D. Pack, OD, FAAO, Northeastern State University Oklahoma College of Optometry

RESULTS: Using Levene's test for equality of variance with a significance level of 0.05 and the t-test for equality with a 95% confidence interval, there was a statistically significant difference in IOP change between group 1 (the brush application group, mean/ IOP= -1.893mmHg +/-2.846) and group 3 (the placebo group, mean /IOP= -0.269 mmHg +/- 1.779). Using the same t-test for equality 95% confidence interval and the Levene's test for equality of equal variance with a significance level of 0.5, there was no statistically significant difference in eyelash growth between groups 1(the brush application group, mean lash growth= 2.500mm +/- 1.528) and 2 (the fingertip application group, mean lash growth = 2.375 +/- 1.345).
PURPOSE: Our first objective was to discover if applying bimatoprost 0.03% to the eyelashes would result in a statistically significant decreased intraocular pressure (IOP). The second objective was to determine if applying bimatoprost 0.03% to eyelashes with an applicator brush yields a greater amount of eyelash growth than when applying with a clean, dry fingertip.
METHODS: Participants were divided into one of three groups by random draw. One group used bimatoprost 0.03% applied with Latisse® applicator brushes. The second group used

bimatoprost 0.03% applied with a clean, dry fingertip. The final group served as a control group and applied artificial tears using their fingertip. Participants received two exams six weeks apart. At the exams, lash length was measured in millimeters and IOP was taken using the Icare® tonometer.
CONCLUSIONS: Using bimatoprost 0.03% for cosmetic purposes appears to cause a slight decrease in IOP, though the amount of pressure reduction is not the same as if used to manage glaucoma. Practitioners who prescribe the drug for cosmetic use should use caution when prescribing to individuals with chronically low IOPs. If prescribed for cosmetic use, applying Lumigan® with a cleaned fingertip will produce similar eyelash growth results as using Latisse® with the provided applicator brushes.

41. **EFFECTS OF LATISSE ON THE OCULAR SURFACE** (125305)

Pamela Giancola, BS, Claudine Courey, Etty Bitton, OD, MSc, FAAO, Vasile Diaconu, PhD, Jack Wise, MD, University of Montreal School of Optometry

RESULTS: Twenty-eight women (n=28, ages 18-29, avg 23.8/3.5yrs) enrolled in the study. Eleven dropped out of the study with 5 due to discomfort and 6, which were lost to follow-up. Average lash length increased from 6.52 to 8.96mm at the end of the 2 months ($p=0.001$). All symptoms changed negatively throughout, however comfort ($p=0.07$) and dryness ($p=0.04$) were the symptoms that changed the most in the first month. Osmolarity, tear stability, OSDI scores, conjunctival saturation/tint and IOP did not change significantly ($p>0.05$) with the use of LATISSE during the 2 month utilisation.
PURPOSE: LATISSE is used for the treatment of hypotrichosis (insufficient lashes). The active ingredient is bimatoprost, similar to LUMIGAN (for the treatment of glaucoma) with benzalkonium chloride (BAK) as the preservative. Instead of being instilled in the eye (as is the case for LUMIGAN), LATISSE is applied on the upper lid margin. It is well established that chronic use of products having BAK, as in glaucoma users, has found to be irritating to the ocular surface. The aim of this study was to evaluate if LATISSE, even though it is applied to the lid margin, has a similar effect on the ocular surface.
METHODS: Non-dry eye (DE) volunteers had subjective symptoms (comfort, drying, burning, grittiness, vision), tear film stability, osmolarity, length of lashes, conjunctival redness (saturation and tint using a photochromometer), and intraocular pressure (IOP) evaluated prior to the use of LATISSE and 1 and 2 months following the recommended use of the product.
CONCLUSIONS: LATISSE effectively treats hypotrichosis and lengthens eyelashes. Of those that use the product for cosmetic reasons alone, they will most probably use it long term, hence potentially increasing the likelihood of irritation to the ocular surface. Even though Canadian optometrists cannot prescribe LATISSE at this time, it is important that they discuss potential symptoms and look for irritation of the ocular surface with prolonged use. Further studies are needed to determine if the cause of dryness and discomfort are linked to the preservative, BAK.

42. **BEPOTASTINE BESILATE OPHTHALMIC SOLUTION IMPROVES INSTANTANEOUS-REFLECTIVE TOTAL NASAL SYMPTOM SCORE IN SEASONAL ALLERGIC RHINOCONJUNCTIVITIS SUBJECTS** (125436)

Jon Williams, PhD, FAAO, James Allen Gow, BSc (Med), MD, FAAO, Mauricio Munoz, PharmD, ISTA Pharmaceuticals, Doral Fredericks, PharmD, Bausch + Lomb

RESULTS: In a post-hoc analysis, BBOS 1.5% was superior to placebo in alleviating the time to a 1.0 unit improvement for both iTNSS and rTNSS (P = 0.010 and P = 0.031, respectively). The safety profiles of BBOS 1.5% and the placebo groups were similar.
PURPOSE: To confirm prior observations of efficacy for bepotastine besilate ophthalmic solution (BBOS) 1.5% compared to placebo dosed BID in alleviating nasal symptoms in a natural allergen exposure setting. The mean change from baseline in a time-to-event analysis of instantaneous and reflective Total Nasal Symptom Scores (iTNSS and rTNSS respectively) of nasal pruritus, nasal congestion, sneezing, and rhinorrhea associated with allergic rhinoconjunctivitis was assessed as an indicator of clinical benefit.
METHODS: Eligible subjects with active ocular and nasal allergic symptoms were enrolled. Following randomization, 245 subjects at 12 clinical sites were assigned to placebo or BBOS 1.5% eyedrops and self-dosed BID for 14 days. Individual nasal symptom assessments were conducted using a 4-point scale (0-3 units) and were recorded twice daily. Subject-reported grading was used for both instantaneous and reflective scoring. iTNSS and rTNSS, each with maximum possible values of 12 units, were calculated as the sum of the individual equally weighted scores for nasal pruritus, nasal congestion, sneezing, and rhinorrhea. Baseline scores were determined as the averaged responses of the last 7 assessments prior to the first dose of BBOS 1.5% or placebo. P-values comparing the treatment groups were determined using a log-rank test.
CONCLUSIONS: BBOS 1.5% was superior to placebo in alleviating nasal symptoms as evaluated through examining iTNSS and rTNSS over a 2-week treatment period.

43. **PATIENTS PREFERRED BEPOTASTINE BESILATE 1.5% TWICE DAILY OVER OLOPATADINE HYDROCHLORIDE 0.2% ONCE DAILY FOR TREATMENT OF ALLERGIC CONJUNCTIVITIS** (125486)
Craig F. McCabe, MD, PhD, Murfreesboro, TN

RESULTS: RESULTS: According to the mean daily diary responses, both treatments were very comfortable, and at study end there was no significant difference in the number of patients preferring one treatment over the other for comfort. However, at study end, 63.3% of patients preferred bepotastine besilate 1.5% for all-day relief of ocular itching (P = 0.04), and 66.7% preferred a prescription for bepotastine besilate 1.5% to treat their allergic conjunctivitis (P = 0.01).
PURPOSE: PURPOSE: To evaluate patient eye drop preference when treating allergic conjunctivitis with bepotastine besilate ophthalmic 1.5% solution compared with olopatadine hydrochloride ophthalmic 0.2% solution.
METHODS: METHODS: Consecutive patients (n = 30) presenting in September 2011 with ocular itching associated with allergic conjunctivitis and itchy/runny nose participated in this randomized, single-masked, crossover study. Patients were treated with bepotastine besilate 1.5% twice daily (at approximately 7:00 AM and 4:00 PM) or olopatadine hydrochloride 0.2% once daily (at approximately 7:00 AM) for 14 days. Following a 7-day washout period during which only preservative-free artificial tears

were used twice daily, patients were crossed-over to the other treatment for 14 days. Every day at 8:00 PM, patients recorded in a daily diary how comfortable their eye drop felt (graded on a 1-5 scale, with 5 being very comfortable). At study end (Day 35), patients were asked their treatment preference for eye drop comfort, itching relief, and their next prescription to treat their allergic conjunctivitis.
CONCLUSIONS: CONCLUSIONS: Despite equal eye drop comfort, two-thirds of patients preferred bepotastine besilate 1.5% ophthalmic solution over olopatadine hydrochloride ophthalmic 0.2% solution for treatment of allergic conjunctivitis.
ADDITIONAL COMMENTS: ACKNOWLEDGEMENT: A research grant was provided by ISTA Pharmaceuticals for this investigator initiated study.

44. **THE ABILITY OF ALCAFTADINE 0.25% AND OLOPATADINE 0.2% TO REDUCE OCULAR ITCHING AT 16 AND 24 HOURS IN A CAC™ MODEL OF ALLERGIC CONJUNCTIVITIS** (125606)
Stacey Ackerman, MD, Philadelphia, PA, Jack Greiner, OD, PhD, Boston, MA, Francis D'Ambrosio, MD, Acton, MA, Linda Villanueva, COT, David Hollander, MD, MBA, Allergan LLC

RESULTS: 127 subjects were enrolled and 115 completed the study. Both actives achieved statistical significance vs. placebo at 16 and 24 hrs post-instillation ($p<0.0001$) for reduction of mean ocular itching. Alcaftadine was numerically superior to olopatadine at all time points, achieving a statistically significant difference at 3 minutes (16 hrs) ($p=0.0263$). Both actives demonstrated superiority over placebo with respect to the percentage of subjects reporting itch scores <1 at 3 minutes (16 & 24 hrs) ($p<0.0001$). When the actives were compared, a higher percentage of subjects in the alcaftadine group reported itch scores <1 at both 16 hrs (77.5% - alcaftadine, 46.3% - olopatadine) ($p=0.0058$) and at 24 hrs (71.1% - alcaftadine, 47.4% - olopatadine) ($p=0.0611$). There were no treatment-related adverse events or serious adverse events during the course of the study.
PURPOSE: To evaluate the reduction in ocular itch provided by alcaftadine 0.25%, olopatadine 0.2%, or placebo at 16 & 24 hrs after dosing.
METHODS: A 3-arm (alcaftadine 0.25%, olopatadine 0.2%, or placebo) study used the standard Conjunctival Allergen Challenge (CACTM) model. Subject-assessed ocular itching was evaluated using a 0-4 scale. Subjects underwent CACTM at 16 and 24 hrs after masked study medication instillation, and itching was evaluated at 3, 5 and 7 minutes post-CACTM
CONCLUSIONS: Alcaftadine and olopatadine were safe, well-tolerated and demonstrated superiority to placebo at 16 & 24 hrs in reducing ocular itching. Alcaftadine demonstrated greater efficacy than olopatadine at the earliest time point measured in a CAC™ model.

45. **EYE INJURY SECONDARY TO AMBIEN SLEEP EATING** (125896)
Susan Kovacich, OD, FAAO, Indiana University School of Optometry

BACKGROUND: Ambien (zolpidem) is a prescription medication indicated for insomnia and some brain disorders. It is a short-acting nonbenzodiazepine hypnotic that

potentiates gamma-aminobutyric acid (GABA), an inhibitory neurotransmitter. Zolpidem acts by binding to GABA A receptors at the same location as benzodiazepines. This medication has been associated with abnormal thinking, behavior changes and complex behaviors such as sleepwalking, sleep eating and sleep driving.
CASE REPORT(S): PB, a 63 YO retired female, presented with an acute eye injury. Two days earlier, she awoke, covered in the remains of a sundae, and found her glasses broken with an opened box of half eaten cookies on the floor next to the bed. She recognized the signs of an episode of sleep eating caused by Ambien (Ambien eating.) Although this medication is prescribed for the short-term treatment of insomnia, this patient had been taking Ambien for about ten years, and had previous bouts of eating in her sleep. When she looked in the mirror, she discovered a black left eye and later that day noticed a new floater in that eye. Her exam was remarkable for ecchymosis of the upper and lower left lid and an acute posterior vitreous detachment (PVD) in that eye with no evidence of retinal holes, tears or breaks. She was examined again in one week for re-evaluation. This exam revealed resolving ecchymosis of the left eye and a stable PVD OS with no retinal involvement. The patient quit the Ambien cold turkey after this episode even though she was aware that abrupt discontinuation of this medication could cause severe side effects, such as seizures and delirium.
CONCLUSIONS: Ambien is a medication prescribed for the short-term treatment of insomnia that has been associated with episodes of altered behavior including sleepwalking and sleep eating. Due to the exposed nature of the eye, it is possible to experience an eye injury during one of these episodes, as in the case of our patient. Fortunately for her, she had no permanent injury or vision loss.

46. CASE REPORT OF EPI-ON CORNEAL COLLAGEN CROSS-LINKING (CXL) IN A 9 YEAR OLD MALE WITH FAST RESPONSE TO TREATMENT (125840)

Pinar Haytac, Carlos Buznego, Gabriela Perez, William Trattler, MD, Center for Excellence in Eye Care, Roy Rubinfeld, Cherry Chase, MD

BACKGROUND: Corneal collagen cross-linking is a technique which uses UV light to strengthen chemical bonds in the cornea in combination with riboflavin drops. The goal of the treatment is to halt progressive changes in corneal shape known as ectasia. These ectatic changes are typically marked by corneal thinning and an increase in the anterior and/or posterior curvatures of the cornea, and often lead to high levels of myopia and astigmatism. The most common form of ectasia is keratoconus.
CASE REPORT(S): A 9 year old male with bilateral keratoconus underwent uncomplicated Epi-on CXL with topical anesthetic. The patient was out of soft contact lenses 1 month prior to treatment. Outcome measures included UCVA, BSVA and refractive changes. Pentacam and topography were measured at pre-op and post-op visits. Corneal hysteresis (CH) and corneal resistance factor (CRF) were measured using Ocular Response Analyzer (ORA). Pre-op UCVA improved 6 lines OD from 20/200 to 20/50 and OS from 20/100 to 20/25 on post-op day 1. Post-op day 2 BSVA OD showed an improvement from 20/50 to 20/40 with a manifest refraction of -2.25+2.00X130 and OS improved from 20/50 to 20/25 with a manifest refraction of -1.25+1.50X035. CH and CRF OD increased from 7.5 to 7.9 and 6.2 to 8.1, respectively. Pre-Op CH and CRF OS

increased from 7.5 to 8.9 and 5.9 to 8.4, respectively.
CONCLUSIONS: Epithelial-on CXL can result in rapid visual improvement as well as improvement in corneal shape and corneal strength in some patients.
ADDITIONAL COMMENTS: ASCRS 2011 in San Diego, California and ESCRS 2011 in Paris, France Topic: Open-Label Evaluation of Degree of Accommodation in Pseudophakic Patients With Bilateral Monofocal Intraocular Lenses

47. **AN ATYPICAL CASE OF CORNEAL ENDOTHELIITIS IN A PREGNANT WOMAN** (125044)
Zanna Kruoch, BS, OD, University of Houston College of Optometry

BACKGROUND: Corneal endotheliitis is a ocular manifestation associated with viral conditions such as herpes simplex (HSV). It is characterized by inflammation of the corneal endothelium, resulting in the formation of keratic precipitates (KPs) and corneal edema. A case report of a 30-week pregnant patient is presented showing clinical signs of endotheliitis with the exception of KPs.
CASE REPORT(S): A 33 y/o female presented with a complaint of a progressive "white spot" in the middle of her left eye that affected vision. Visual acuities (sc) were OD 20/20 and OS 20/25. Intraocular pressures were OD 11 mmHg and OS 12 mmHg. Biomicroscopic examination of the left eye revealed a white lesion consistent with disciform corneal edema. No KPs, corneal neovascularization, or frank inflammation of the anterior chamber were evident. Posterior structures were obscured due to the media opacity. Laboratory testing was positive for the presence of HSV IgM and IgG antibodies. This patient was diagnosed with corneal endotheliitis secondary to HSV. Topical therapy of brimonidine tartrate 0.15% was initiated while valacyclovir hydrochloride 500 mg po was prescribed by her obstetrician gynecologist (ob/gyn) a few days later. Over a course of four weeks, there was a worsening of the condition, despite conclusion of the course of the anti-viral. After receiving clearance from the patient's ob/gyn, therapy was switched to trifluridine and prednisolone actetate 1% ophthalmic solutions. Antiviral therapy was re-initiated by her ob-gyn until the cessation of her pregnancy. This collaborative change in management of this patient led to the improvement of the condition, resulting in a light corneal opacity with pinhole acuity of 20/25.
CONCLUSIONS: Corneal endotheliitis can be managed effectively with the combination of anti-viral and anti-inflammatory agents, although considerations do need to be taken into account on the infectious etiology. When the situation is complicated by a pregnancy, caution and co-management is warranted.

48. **CORNEAL EROSION: AN ATYPICAL OCULAR SARCOIDOSIS COMPLICATION** (125175)
Sara A. Bierwerth, OD, Melissa A. Vitek, BS, OD, Pennsylvania College of Optometry at Salus University

BACKGROUND: Sarcoidosis is a chronic, multi-organ granulomatous inflammatory disease of unknown etiology. This case report presents a patient with corneal erosions secondary to sarcoid-associated conjunctival granulomas. Treatment options for this

condition as well as possible surgical options are also discussed for case management.
CASE REPORT(S): A 39 year-old African American male presented with complaints of acute pain and photophobia in his right eye. His medical history was remarkable for sarcoidosis diagnosed nine years ago. Clinical evaluation revealed corneal erosions secondary to exposure keratopathy in the setting of ectropion from large cicatricial conjunctival granulomas. The patient's corneal erosions were treated with a therapeutic contact lens, topical cycloplegia, and topical prophylactic antibiotics. Oculoplastic consultation was recommended, as this patient would benefit most from debulking and surgical excision of his granulomas, along with dacryocystorhinostomy to aid in proper tear drainage.
CONCLUSIONS: Corneal erosions secondary to ectropion from sarcoid-associated conjunctival granulomas have the potential to cause devastating ocular effects, including blindness. It is essential to detect exposure keratopathy early and intervene, including a multidisciplinary management approach to prevent the development of ocular sequelae.

49. UVEITIS-GLAUCOMA-HYPHEMA (UGH) SYNDROME EXACERBATED BY HIGH-DOSE ASPIRIN THERAPY IN A DIABETIC PATIENT SECONDARY TO AN IRIS-FIXATED INTRAOCULAR LENS

(125191)
Kim T. Nguyen, OD, Southern California College of Optometry

BACKGROUND: Uveitis-glaucoma-hyphema (UGH) syndrome is a rare complication associated with intraocular lens malpositioning, which is less common now due to improved technology with cataract extraction. UGH syndrome typically occurs due to mechanical irritation at the iris and on adjacent structures. This case highlights an unusual etiology exacerbated by ASA desensitivity therapy.
CASE REPORT(S): A 65 yo Caucasian male presented with a complaint of intermittent plumes of floaters in OD starting several weeks prior. He had a history of a dislocated iris-fixated PCIOL, retinal detachment s/p scleral buckle, epiretinal membrane with macular hole in OD. His medical history consisted of DM type II, asthma, and hypertension. He was taking medications for asthma, HTN and DM as well as 1.3 grams of aspirin initiated for aspirin desensitivity therapy. BCVA was 20/70 OD and 20/20-1 OS. He had an irregular pupil with decreased constriction OD but no APD. Ocular health exam revealed 3+ swirling red blood cells in the anterior chamber, increased IOP of 34mmHg, and diffuse vitreous hemorrhage in OD. B-scan ultrasound revealed no retinal breaks. We attributed the anterior chamber RBCs, increased IOP, and vitreous hemorrhage to iris traction from the iris sutured PCIOL, which was greatly exacerbated by 1.3 grams ASA daily. Although we requested the patient decrease his aspirin intake, he declined preferring to continue his desensitivity treatment. Management involved monitoring resolution of the vitreous hemorrhage, lowering IOP with topical medications, and starting Pred Acetate to decrease the anterior chamber reaction.
CONCLUSIONS: UGH is a rare complication secondary to IOL malpositioning due to the chafing of the lens against the iris and adjacent structures which can lead to uveitis, increased intraocular pressure, and hyphema. This case highlights a unique case of a patient exhibiting UGH syndrome from an iris-sutured PCIOL which was likely exacerbated by diabetes and a high-dose aspirin regimen.

50. **PEDIATRIC APHAKIC CONTACT LENS FITTING FOR LOWE SYNDROME** (125204)

Yi-San Lee, OD, Veronica L. Woi, BS, OD, David P. Libassi, OD, FAAO, State University of New York (SUNY) College of Optometry

BACKGROUND: Lowe Syndrome, a rare genetic disorder, involves a single mutation of the gene OCRL1. This condition causes a deficiency in the essential enzyme, PIP2-5-phosphatase, and can lead to multiple organ complications. Patients with Lowe Syndrome may develop renal failure, mental retardation, bilateral congenital cataracts, and glaucoma. These young patients typically undergo bilateral cataract extraction early in life, and after surgery, aphakic contact lens fitting is warranted. However, several cases of corneal keloids have been reported in Lowe Syndrome patients, which can further complicate the contact lens fitting process.
CASE REPORT(S): A two-year old Chinese male, DL, presented with his parents to the University Eye Center on July 21, 2011 for a contact lens re-fitting. After early renal failure and bilateral cataract extraction surgery, DL was diagnosed with Lowe Syndrome and genetic testing confirmed the diagnosis. DL was previously fit by another optometrist with Bausch + Lomb's Silsoft contact lenses OU and was a successful daily lens wearer for the first four months. A slight change was made to the lens power, but other parameters were maintained. On May 2, 2012, after a series of follow-up visits, two newly noted white lesions were found in his right eye at three and eight o'clock. They appeared to be elevated, without any neovascularization, and near the cataract extraction incision wound site. It is unclear if these lesions are hypertrophic scars secondary to the cataract extraction procedure or if they are indeed corneal keloids. While they currently have no effect on the corneal-contact lens fitting relationship, close observation is necessary to monitor for the progression of these lesions and if they lead to difficulty with contact lens wear.
CONCLUSIONS: The increased likelihood of secondary corneal scarring can post challenges to successful contact lens wear in aphakic infants with Lowe Syndrome. Close monitoring of the anterior segment, especially for the development of corneal keloids, is essential to maximize ocular health in this young patient population.

51. **A BLOODY CONUNDRUM - ATYPICAL RESOLUTION OF A TRAUMATIC HYPHEMA** (125254)

Michael J. Schumacher, OD, Indian Health Service

BACKGROUND: The majority of traumatic hyphemas are uncomplicated grade 1 occupying less than 1/3 of the anterior chamber. They usually resolve within 7-10 days and patients need to be monitored for complications such as rebleeds, elevated IOP, and corneal blood staining.
CASE REPORT(S): A 40 year old Navajo male presented to the clinic one day after being hit in the left eye with a closed fist. His vision was HM@6ft with 4+suspended RBC/WBCs, a plasmoid aqueous, and grade 1 layered hyphema. Bscan showed no gross posterior segment abnormalities. Topical prednisolone and atropine were started and he was restricted to bed rest with head elevation at 30-45 degrees. His vision improved to

20/50 by day 2 as the aqueous cleared and the hyphema settled. He had rebleeds seen in office on days 2, 3, and 4. Improvement was noted by day 5 and we continued outpatient monitoring. He had rebleeds on days 12 and 19 after admittedly fixing his transmission and chopping and hauling several loads of wood to heat his home. He had another rebleed on day 37 and additional treatment with oral prednisone was started on day 46 after recovery from an upper respiratory infection. No additional evidence of rebleeding was seen as the hyphema level stayed stable until day 65, when it slowly began to decrease, presumably as a result of increased compliance due to initiation of video game use. The hyphema finally resolved on day 110. His IOP remained between 6mmHg and 13mmHg through the duration of the hyphema and no evidence of corneal blood staining prompting surgical evacuation was noted. All blood tests were normal except low vitamin K levels.
CONCLUSIONS: Further testing, including blood work to monitor for bleeding disorders and/or blood dyscrasias, are warranted should the hyphema follow an atypical course, including rebleeds past the normal window (3-5days) or for persistent hyphemas. Vision loss due to hyphema alone is exceedingly rare as permanent vision loss is most likely the result of either short or long-term traumatic ocular sequelae. This case also illustrates the importance of patient compliance.

52. **CYTOMEGALOVIRUS-INDUCED ENDOTHELIITIS** (125426)
Matthew L. Willis, OD, Gretna, NE

BACKGROUND: Cytomegalovirus (CMV) historically caused concern for retinitis in immunocompromised patients, but there have been increasing reports of anterior segment inflammation caused by CMV. Many cases had been previosuly managed as unresponsive cases of uveitis or endotheliitis secondary to herpes simplex virus (HSV), varicella zoster virus (VZV), or from an idiopathic cause, until aqueous sampling later revealed the presence of CMV. Upon diagnosis, this condition shows a good response to treatment with oral Valganciclovir.
CASE REPORT(S): A 64 year-old white male was referred to our eye clinic due to the presence of CMV inclusion bodies from a biopsy of a pre-pyloric ulcer. Although asymptomatic, his acuity was 20/30- in the left eye and he had diffuse scattered pigmented KP's on the endothelium and haze and edema on the entire inferior half of cornea with overlying microcystic edema. There was pigment dusting on the temporal iris and a loss of the iris border causing on irregular pupil and transillumination defects. There was also a mild anterior chamber reaction and IOP in the high 30's. A good clinical response was seen after starting the patient on oral Valganciclovir 900mg bid. A recurrence of the disease occurred after tapering his medication, and prompt response was seen after increasing treatment to the original dosage.
CONCLUSIONS: CMV endotheliitis is a recently recognized entity that should be considered in cases of recurrent or unresponsive endotheliitis or uveitis. The fact that aqueous sampling is not always performed in such cases may limit the numbers of reported cases at this point. Common signs include corneal edema, pigmented KP's (coin-shaped lesions), mild anterior chamber reaction, iris atrophy, and elevated IOP.

Treatment with Valgancicylovir 900 mg bid is a widely-accepted protocol for treatment of this condition. Careful monitoring is needed, especially if attempting to taper or discontinue the medication, due to many reported cases of recurrence. Main causes of vision loss in this condition are from secondary glaucoma or endothelial failure.

53. **PELLUCID MARGINAL DEGENERATION BEFORE AND AFTER CORNEAL COLLAGEN CROSS-LINKING TREATMENT** (125431)
Dorcas Tsang, BS, OD, Western University of Health Sciences College of Optometry

BACKGROUND: Pellucid marginal degeneration (PMD) is a bilateral thinning of the peripheral inferior cornea causing ectasia in and around the thinned region. It has been reported to be associated with collagen abnormalities. Spectacles; toric soft, rigid, hybrid, and scleral contact lenses; lamellar or penetrating keratoplasty; and intrastromal ring segment insertion have all been prescribed/performed to improve vision and/or prevent progression of PMD. Collagen cross-linking (CXL) with riboflavin and ultraviolet-A light (UVA) has been utilized in recent years to slow the progression of corneal ectasia caused by keratoconus and refractive surgeries. This case study reports the short-term results of CXL with riboflavin-UVA irradiation on corneas with PMD.
CASE REPORT(S): A 26-year-old Caucasian male presented to the Eye Care Center for the first time for a comprehensive eye examination complaining of moderate blurriness which was more noticeable in the left eye. Corneal topography revealed the classic "kissing birds" pattern of PMD in the left eye, and mild against-the-rule astigmatism in the right eye. Baseline refraction, keratometry, corneal biomechanics (hysteresis) and thickness mapping were also obtained. After CXL with riboflavin-UVA was performed on both eyes, patient returned every 6 to 8 weeks for follow-up. Refraction; keratometry; corneal hysteresis, thickness, and topography were repeated at these visits.
CONCLUSIONS: Since patient was correctable at baseline to 20/20 in each eye with spectacles, and 20/20 & 20/25-2 with hydrophilic toric lenses in the right eye and left eye, respectively, vision stability was expected and maintained post-treatment. The induced cross-linking of collagen with riboflavin-UVA light to treat PMD modifies the biomechanical properties of the corneas immediately after treatment but trends toward baseline as the corneas stabilize. Axial curvature map difference and trend analyses were performed using the Zeiss ATLAS 9000 software, while corneal biomechanical properties was measured using the Ocular Response Analyzer.

54. **NEURODEGENERATIVE DISEASE: A CAUSE FOR A CHRONIC RED EYE** (125579)
Olga Pikus, OD, Harriette M. Canellos, OD, FAAO, State University of New York (SUNY) College of Optometry

BACKGROUND: Ataxia telangiectasia, also known as Louis-Bar Syndrome, is a rare, autosomal recessive, neurodegenerative disease characterized by early onset progressive cerebellar ataxia, oculocutaneous telangiectasias, ocular motor apraxia, dysarthria and immunodeficiency. The pathophysiology remains unknown, however, laboratory observations reveal a defect in DNA repair. The affected cells are extremely sensitive to irradiation and chemical mutagens that cause spontaneous mutations on chromosome 14

and result in premature aging to sun-exposed skin and hair and the development of malignant tumors. Ocular manifestations include conjunctival telangiectasias and ocular motor apraxia, an inability to initiate saccadic eye movements. Conjunctival telangiectasias are large dilated venules on the bulbar conjunctiva that appear by age 2. The child presents with a "red eye" that is often misdiagnosed as a chronic conjunctivitis with no discharge or other signs of infection. Over time, sun exposed skin on the face, ear lobes, neck and upper extremities develop similar venules.
CASE REPORT(S): A sixteen year old white male presented to our clinic with bilateral chronic red eyes without any symptoms of ocular infection or inflammation. His medical history was significant for ataxia telangiectasia and cerebellar degeneration, confirmed with an MRI. A profound deficit was noted in motor function and speech. The ocular findings were significant for bilateral, grossly engorged venules on the bulbar conjunctiva which contributed to the clinical appearance of a chronic red eye. Additionally, oculomotor deficits, an inability to initiate saccades and smooth pursuit movements, were observed concurrently with a variable gaze dependent pendular nystagmus.
CONCLUSIONS: The conjunctival abnormalities are of diagnostic value. Although they are cosmetically disturbing and can be alarming even to the practitioner, it should be noted that they do not affect visual function. Conjunctival telangiectasias and oculomotor apraxia that occur simultaneously with cerebellar degeneration is diagnostic of ataxia telangiectasia.

55. OFF-LABEL ANTI-VEGF THERAPY IMPROVING LONGSTANDING CORNEAL NEOVASCULARIZATION: A NEW APPROACH TO AN OLD PROBLEM (125626)

C.Lisa Prokopich, BSc, OD, Sarah MacIver, OD, FAAO, University of Waterloo School of Optometry and Vision Science

BACKGROUND: Corneal neovascularization (CNV) may develop as a result of a number of infectious, inflammatory, degenerative and traumatic ocular diseases including herpes simplex virus (HSV) keratitis. These conditions may precipitate an “angiogenic switch” whereby the balance between anti- and pro-angiogenic factors in the cornea shifts towards neovascularization. The relevance of VEGF in CNV is well established, and the inhibition of VEGF with both bevacizumab and ranibizumab are being investigated as off-label treatment options. Subconjunctival (SC) injections of bevacizumab have been shown to reduce CNV by 25% at 3 months. Local complications include pain at the injection site, SC hemorrhages and ocular irritation. Intravitreal injection of bevacizumab (off-label) has been linked to an increased risk of life-threatening conditions such as hypertension and thromboembolic events, therefore, route of administration of these drugs is critical to minimizing such events.
CASE REPORT(S): This case describes a 50 yo woman who developed CNV after a severe episode of stromal HSV keratitis following the removal of a large acoustic neuroma 8 years prior. Ocular surface disease due to resultant CN7 palsy was managed with gold weight implantation along with intense treatments of lubrication, lid care, pulse steroids, lacrimal occlusion, and the use of moisture chambers. This past year, she developed recurrences of the HSV disease (episcleritis) and a reactivation of stromal disease. Evaluation of serial anterior segment photographs suggested progression of the

CNV and she was started on prophylactic antiviral therapy. After three injections of bevacizumab, the vessels regressed away from the pupil margin and the density of the neovascularization was reduced.
CONCLUSIONS: We present a case of established CNV that regressed with injections of bevacizumab. While very new and as yet off-label, both injected and topical routes of administration of anti-VEGF therapies appear to be successful treatment options for patients with CNV.

56. **NEW CORNEAL OPACITIES UNCOVER POORLY CONTROLLED MAPLE SYRUP URINE DISEASE (MSUD)** (125361)
Yu Su, OD, FAAO, New England College of Optometry, Jennifer Q. Duan, OD, FAAO, Arlington, VA, Andrew Gurwood, OD, FAAO, Pennsylvania College of Optometry at Salus University

BACKGROUND: Maple syrup urine disease (MSUD) is a congenital autosomal recessive metabolic disorder which occurs when an enzyme complex for metabolizing the branched amino acids leucine, valine and isoleucine is rendered inactive. Its estimated incidence is 1:120,000-400,000 live births. A signature symptom of the disease is the production of urine that smells like maple syrup 12-24 hours after delivery. When left untreated the disease is lethal. Metabolic homeostasis can be restored using strict dietary control. Properly treated cases typically develop normally. Corneal degenerative changes have been documented in cases experiencing amino acid disequilibrium.
CASE REPORT(S): A 10-year-old Salvadorian boy known to have MSUD, medicating with Ketonex-2TM formula and strict diet (low in natural proteins), presented for his routine eye examination. His records revealed no prior ocular pathology. The anterior segment evaluation uncovered the presence of a new band-shaped, white opacity with thick scalloped boarders within the inferior mid-peripheral superficial corneal layers, OD. The off-axis nature of the lesion permitted it to exist without interfering with his vision or producing any symptoms. Prompted by this discovery, a review of his recent labratory report showed that his leucine levels had increased significantly. His managing specialist was notified with a request to rule out under or ineffective treatment. The patient was seen in two months for a follow up having undergone systemic therapy modification. At that visit the corneal lesion had regressed appearing smaller and more transparent. Correspondence from the managing specialist included new lab work confirming reduced leucine levels.
CONCLUSIONS: Inadequate corneal epithelial nutrition may alter the integrity of the corneal tissue. MSUD has the potential to create a deficiency of specific amino acids integral for corneal health. We review this unusual disease, its ocular sequellae, its etiology, signs and symptoms as well as the varied approaches to management.

57. **TERRIEN MARGINAL DEGERATION WITH INFLAMMATORY EPISODES** (125630)
Michelle M. Hessen, OD, Esen Akpek, MD, Johns Hopkins University Wilmer Eye Institute

BACKGROUND: Terrien marginal degeneration is a rare, bilateral, slowly progressive peripheral corneal stromal thinning disorder. The classic form occurs mostly in patients older than 40 years, non-inflammatory, and shows slow progression. A variant form with prominent inflammatory signs has been documented in a younger population. Recent reports support the hypothesis of an inflammatory process via in vivo confocal microscopy. Treatment consists of observation, correction of induced astigmatism, and surgical intervention in severe cases where the ocular integrity is threatened.
CASE REPORT(S): 65yo/W/M presented with history of multiple inflammatory episodes of both eyes since adolescence, which were treated with topical steroids and NSAIDs. Vision continued to progressively worsen. Review of symptoms was significant for joint inflammation, chronic dry mouth, dry eyes, and irritable bowel syndrome. Visual acuity was 20/30+ OD, 20/50 OS. Slit lamp examination demonstrated each cornea had peripheral stromal thinning, neovascularization almost 360 degrees OD and 270 degrees OS along with lipid deposition. A presumptive diagnosis of peripheral inflammatory corneal disease was made. Despite negative lab work-up to uncover a possible inflammatory disorder, the clinical presentation was consistent with peripheral collagen wasting. Bromfenac was discontinued, as topical non-steroidal anti-inflammatory agents may cause corneal thinning and dryness. Mycophenolate, an immunomodulation treatment, was started by Rheumatology and no inflammatory episodes have reoccurred in eight months. Reduction in best-corrected visual acuity and monocular diplopia was addressed with Prosthetic Replacement of Ocular Surface Ecosystem (PROSE) treatment resulting in single vision of 20/20 OD, 20/25 OS.
CONCLUSIONS: This case demonstrates the importance of considering a systemic etiology for progressive corneal thinning and neovascularization. Co-management with Rheumatology is essential for treatment to stabilize such condition. PROSE treatment may be utilized for reduced vision due corneal irregularities.

58. THE APPEARANCE OF BLUE EYES IN A PATIENT WITH BROWN IRIDES: A RARE CASE OF CONGENITAL HEREDITARY ENDOTHELIAL DYSTROPHY (125472)

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BACKGROUND: Congenital Hereditary Endothelial Dystrophy (CHED) is a rare corneal dystrophy characterized by the presence of diffuse bilateral progressive stromal edema leading to the classic bluish-white ground-glass appearance of the cornea. It is believed to result from deficient terminal differentiation leading to hypoplasia or degeneration of corneal endothelial cells. Two forms exist: CHED1 (autosomal dominant) and CHED2 (autosomal recessive). CHED2, the most common form, manifests itself within the neonatal period and is stationary, asymptomatic and associated with nystagmus. CHED1 appears at the age of 1 or 2 years old with tearing and photophobia, slowly progresses during childhood, and lacks nystagmus. Differential diagnosis of congenital corneal clouding includes Peters Anomaly, sclerocornea, limbal dermoid and congenital glaucoma. CHED has also been associated with congenital glaucoma. CHED2 may be associated with Harboyan syndrome, where it is accompanied

by slowly progressive hearing loss in early childhood.
CASE REPORT(S): A 30 y.o. male presented to our clinic with entering acuities of 20/600 OD, 20/400 OS. Slit lamp examination revealed bilateral diffuse bluish-white stromal edema as well as brown and flat irides. Applanated intraocular pressures measured 12 OD, 13 OS. A horizontal nystagmus was noted. History revealed stable appearance of eyes since birth and the presence of the condition in family members. Due to the above findings, the patient was diagnosed with CHED2.
CONCLUSIONS: CHED is a rare corneal dystrophy that can cause significant visual compromise due to the severe corneal edema and the resulting amblyopia. Management and treatment options are discussed for both the adult and the pediatric patient, including Descemet's stripping automated endothelial keratoplasty (DSAEK). In addition, with the advancement of anterior segment OCT, the condition can be more accurately monitored. Comprehensive care may also include audiometric monitoring for all patients with CHED2 in order to rule out Harboyan syndrome.

59. **RISK FACTORS FOR KERATOCONUS IN PALESTINIAN ARABS** (125518)

Ariela Gordon-Shaag, PhD, Hadassah College, Michel Millodot, FAAO, The Hong Kong Polytechnic University School of Optometry, Jeanne Garth, MD, Maron Essa, BOptom, Mohammed Ghara, Shatha Abd-el- Kadder, BOptom, Einat Shneor, BOptom, PhD, Hadassah College

RESULTS: Overall, 180 patients (60 cases and 120 controls) with a mean age of 25.53 ±7.59 were studied. The following risk factors were found to be associated with KC: eye rubbing (56.7% vs. 5.8 %; $p<0.0001$, Fisher exact test, OR 21.1 95% CI 7.9-61.5), allergies (15.0% vs. 2.5%; $p<0.003$. Fisher exact test, OR 6.9 95% CI 1.6-40.6), consanguinity (38.3% vs. 15.8%; $p<0.001$, Chi-square, OR 3.3 95%CI 1.5-7.2) and family history of KC (20.0% vs. 2.5%; $p<0.001$, Chi-square, OR 9.8 95%CI 2.5-55.4). Sunglass use provided a strong protective factor (44.35 vs. 81.7%, $p<0.001$ chi-square, OR 0.17, 95%CI 0.08-0.36).
PURPOSE: Keratoconus is a progressive non-inflammatory corneal thinning disorder. Several studies suggest that both environmental and genetic factors play a role in the etiology of KC, but a definite etiology has not been established. Our Purpose was to elucidate the risk factors of keratoconus in a population sample of Palestinian Arabs.
METHODS: This case-control study included keratoconus patients who were diagnosed by ophthalmologists at the St. John Eye Hospital in Jerusalem. The control group included age and sex matched individuals (1:2 ratio) who were randomly selected from patients at the hospital without KC or any confounding disease or factor, but with other ophthalmic diseases. Study subjects were asked to fill out a self- administered questionnaire that included demographic and geographic details and questions on ocular and general health status. We compared exposures in the KC cases and unaffected controls in order to assess risk factors associated with KC.
CONCLUSIONS: Our results suggest both genetic and environmental influences on the etiology of KC. Eye rubbing and allergies may increase the risk for developing KC. Positive family history of KC and consanguinity were both shown to be significant predictors. Interestingly, the use of sunglasses outdoors provides strong protections

against KC. The results of this study signal a need for public health outreach and intervention for KC.
ADDITIONAL COMMENTS: Dr. Shneor received a grant from the Israel Society for psychobiology

60. **A COMPARATIVE CASE STUDY OF THE DIAGNOSIS AND TREATMENT OF OCULAR SURFACE DYSPLASIAS** (125707)
Bruce C. Barbon, Vanessa M. Santos-Nevarez, OD, Bay Pines, Joseph Allen Miller

BACKGROUND: The term *Ocular Surface Epithelial Dysplasia* encompasses a continuum of tissue changes ranging from benign lesions to malignant transformations. Misdiagnosis of dysplasias is common due to the prevalence of benign lesions and the insidious onset of the clinical signs of dysplasia. Also, a high recurrence rate after surgery warrants greater awareness various treatment modalities associated with these lesions. This report of three cases of surface dysplasia demonstrates the considerations required for accurate detection and treatment.
CASE REPORT(S): Case #1. A 61 year old male presented for evaluation of a "white spot" adjacent to the iris first observed in a mirror, possibly from recent work with plaster. After removal with forceps, recurrence of the lesion ultimately led to treatment with excision and amniotic tissue graft. The lesion again recurred, requiring follow-up treatment with Mitomycin C. Case #2. A 65 year old asymptomatic male with no history of significant sun exposure or skin cancer was found to have a suspicious lesion not present at an exam 6 months prior. He was treated with excision, tissue graft, and Mitomycin C in the same procedure, followed by several weeks of topical chemotherapy. Case #3. A 66 year old asymptomatic male reported for monitoring of a pterygium for progression. He had no significant history of cancer, and his condition was stable one year prior. Examination revealed a diffuse "sheet-like" corneal epithelial opacity extending from a suspicious conjunctival leukoplakia and coursing over nearly six clock hours of the corneal surface. Treatment with excision and tissue graft was successful with concurrent topical chemotherapy.
CONCLUSIONS: Case history, clinical signs, and treatment plan can vary considerably when evaluating surface dysplasias. These cases demonstrate the diversity of clinical considerations encountered when examining surface dysplasias. Knowledge of all aspects of evaluation is essential for successfully differentiating benign lesions from potentially malignant carcinomas.

61. **CORNEAL EPITHELIAL CELL VIABILITY WITH AN EX VIVO PORCINE EYE MODEL** (125043)
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RESULTS: No significant differences were found among the four test PEM in both central and peripheral cornea ($p>0.19$). There were significantly more dead cells in the test PEM compared to the control A ($p<0.001$) but significantly less when compared to control B ($p<0.001$). There were more dead cells in the central cornea than the peripheral

cornea in the test PEM ($p<0.001$) but the difference was not found in control A and B ($p>0.08$).
PURPOSE: To assess consistency of corneal epithelial cell viability of an ex vivo porcine eye model.
METHODS: Six porcine eye models (PEM) (four test and two control) were set up each time and a total of 57 eyes were used (9 were discarded). The effect of blinking and lacrimation were simulated by a mechanical arm and instillation of Dulbecco's Phosphate Buffered Saline (DPBS) respectively. The four test PEM simulated the condition of evaporative dry eye with simulated lacrimation and blinking (one blink and one drop of DPBS/min) over a duration of three hours. Control A were pre-experimental baseline while control B were the same as test PEM but without lacrimation and blinking simulation. The PEM were kept in a closed chamber with temperature and humidity well controlled. At the end of three hours, the cells of all eyes (except control A which were assessed immediately before commencement of the test) were assessed by dipping the eyes into 0.4 % trypan blue solution for two minutes. The central and peripheral trypan blue staining was assessed under the microscope with a field size of 0.25mm².
CONCLUSIONS: The epithelial cell viability assessment among the four PEM with simulated lacrimation and blinking was consistent. The comparison with the control A showed that the most of the cells were viable before the experiment and the comparison with control B showed that simulated lacrimation and blinking allowed more viable cells. The higher number of dead cells in the central cornea in the test PEM could be due to the increased frictional force due to blinking simulation.

62. **INFLUENCE OF MICROTUBULE ASSEMBLY ON WOUND HEALING OF CORNEAL ENDOTHELIUM** (125701)
Mahesh Shivanna, PhD, MCPHS School of Optometry, Sangly Srinivas, PhD, Indiana University School of Optometry

RESULTS: Electroporation led to a precipitous fall in the TER confirming loss of endothelial cells and consequent break down of cell-cell junctions. A similar effect of a sudden decrease in TER was observed following calcium depletion. The % recovery of TER following Ca2+ addback was significantly less ($n=12$; $p < 0.05$) compared to control when cells were re-exposed to nocodazole (1 micromolar), an agent known to disassemble microtubules. The recovery of TER upon electroporation was also retarded in the presence of TNF-alpha (20 ng/ml), which is also known to cause disassembly via activation of p38 MAP kinase. However, pretreatment of the cells with SB-203580, a specific inhibitor of p38 MAP Kinase, opposed the TNF-alpha response.
PURPOSE: Barrier integrity of the corneal endothelium which is dependent on cell-cell junctions is essential for maintaining stromal hydration control. Reformation of cell-cell junctions following focal loss of endothelial cells is therefore a key step in preventing sustained stromal edema following iatrogenic trauma. In this study, we have examined endothelial wound healing in the presence of agents known to induce microtubule disassembly.
METHODS: Reformation of cell-cell junctions was examined by measurement of trans-

endothelial electrical resistance (TER) using automated wound healing assay with electric cell substrate impedance sensing (ECIS). Primary cultures of bovine corneal endothelial cells (BCEC) were grown on gold electrodes (250 micron diameter) and TER was measured continuously (ECIS 1600R; Applied Biophysics, NY) at 4 kHz. Confluent cells were electroporated by exposure to 20 mV for 20 seconds at 40 kHz to induce wounding. Reformation of cell-cell junctions was also examined by the Calcium switch technique. First cell-cell junctions were disrupted by exposure to Ca2+-free DMEM containing 2 mM EGTA and then reformation of junctions was promoted by exposure to 1.8 mM Ca2+.
CONCLUSIONS: Corneal endothelial wound healing response is sensitive to modulators of microtubule cytoskeleton.

63. **ROLE OF LACTATE IN CRYSTALLINE LENS TRANSPARENCY: EXPRESSION OF MCT 1 2 4 IN RABBIT LENS EPITHELIUM** (125306)
Jessilin Quint, Joseph A. Bonanno, OD, PhD, FAAO, Shimin Li, PhD, Indiana University School of Optometry

RESULTS: MCT1, 2, and 4 are expressed in rabbit lens epithelium cells; MCT 3 is not. MCT1 was localized to the lateral membrane, MCT2 was lateral and apical, while MCT4 was primarily apical.
PURPOSE: To identify and localize the monocarboxylate transporter (MCTs) subtypes 1-4 expressed in rabbit lens epithelium cells through a combination of conventional and RealTime-PCR, immunoblotting, and immunofluorescence. Crystalline lens transparency depends on active transport processes that utilize ATP within the lens epithelium. Lens transparency is inversely related to tissue hydration. The active ion transport mechanisms counteract the fixed osmotic effect of lens proteins so that hydration equilibrium is maintained. The lens is very glycolytic and produces a substantial amount of lactic acid that must be removed. If it is not removed, the lens should swell and transparency may be affected. There has been essentially no research on the mechanisms for lactic acid efflux from the crystalline lens. The mechanism of lactic acid efflux is a novel area of research and is an integral part of the transparency puzzle, which must be understood. Our hypothesis is that lactate is removed by monocarboxylate transporters. Here we test if MCTs are present.
METHODS: Lens epithelium was dissected from whole rabbit eyes (Pel-Freez, Arkansas): messenger RNA was extracted from 8 eyes using Trizol reagent, epithelial protein was extracted from 16 eyes using RIPA buffer. MCT1-4 expression was screened by conventional and RT-PCR, Western blot analysis, and immunofluorescence.
CONCLUSIONS: MCT1, 2, and 4 are expressed on both the apical and basolateral membrane surfaces of rabbit lens epithelium cells. Further studies are needed to examine the role of MCTs in maintaining crystalline lens transparency.
ADDITIONAL COMMENTS: BSK Student Research Grant, NIH grant

64. **METHODOLOGY VALIDATION FOR LOW VOLUME SAMPLES USING MSD TECHNOLOGY: APPLICATION TO NORMAL AND DRY EYE TEARS** (125545)

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RESULTS: The modification of the assay for low volume samples was validated for cytokine concentration ranges from 4377 to 17 pg/ml with control samples (r=0.99; p<0.0001). IL-6 and IL-8 were detected in similar concentrations in 1, 2 and 5 µl tear samples in duplicate runs (Normal: IL-6 32.42±1.39 pg/ml 4.28%CV - IL-8 405 ±76 pg/ml 18.8%CV; DE: IL-6 13.91 ±2.46 pg/ml 17.7%CV - IL-8 707±88 pg/ml 12.4%CV). IFN-γ was detected in the dry eye pooled sample at 13.90 ±2.55 pg/ml (18.4%). IL-10, IL-12p70 and TNF-α were not detected in diluted samples. In undiluted samples, IFN- γ, IL-10, IL-6, IL-8 and TNF-α were detected in an inter assay in normal/dry eye samples respectively at 22.3/18.8 pg/ml (80.6/64.4%CV), 4.78/- pg/ml, 48.1/15.1 pg/ml (7.2/0.2%), 570/796 pg/ml (12.6/9.9%) and 11.0/14.84 pg/ml (52/-%).
PURPOSE: The aim of this study was to validate the detection of cytokines in human tears on a Meso Scale Discovery (MSD) Platform with a protocol adapted to low volume samples (1 & 2µl tear samples) compared with the conventional 5µl samples. A second objective was to quantify the levels of cytokines in normal and dry eye pooled samples.
METHODS: Five normal and five dry eye subjects took part in this study. 1µl of tears was collected from each eye and pooled. The pooled samples were analyzed with Human Pro-Inflammatory 7-Plex Assay on MSD platform. Low volume protocols were validated with samples of known concentration (controls). 1, 2 and 5µl of 10 fold diluted tear samples were then compared. A protocol using 1µl tear undiluted samples was also assessed.
CONCLUSIONS: This is the first report of tear cytokine analysis using MSD technology. The low volume protocols are convenient for cytokine detection in tear samples as low as 1 µl with up to six cytokines detected. The results were consistent using both diluted and undiluted methodologies, and a good inter assay reproducibility was obtained for undiluted samples for IL-6 and IL-8.

65. ARTIFACTS IN CYTOMETRIC BEAD-BASED ASSAY OF TEAR IL-9 (125634)

My Tho Karin Tran, John Bradley, OD, Landon Wilson, PhD, Steve Barnes, PhD, Roderick Fullard, OD, PhD, University of Alabama at Birmingham School of Optometry

PURPOSE: Cytometric Bead-based Assay (CBA) allows the assay of multiple biomarkers in small tear samples. However, the multiplex format is more prone to assay interference. Ocular IL-4, IL-5, and IL-13 (Th2) are all detectable in tears along with IL-9 (recently reclassified as a Th9 cytokine). All have potential roles in ocular surface inflammation and allergy. This study looks at interference in tear IL-9 CBA.
METHODS: Tears and conjunctival impression cytology (CIC) specimens were collected at the same visit from 25 patients (normal and dry eye). Tears were assayed by a 27-Plex Bio-Rad CBA. Some tear samples were also subjected to Triple-TOF mass spectrometry (MS) to confirm CBA IL-9 levels. CIC specimens from all patients were

applied to TaqMan 96-gene RT-PCR, which included a range of Th2 cytokines and receptors, IL-9 and IL-9R.
RESULTS: In 23 patients, tear IL-9 levels by CBA were below 100 pg/mL. For the other two patients, IL-9 levels were 1,000 fold higher. This was confirmed in multiple tear collections and CBAs over a 2-year period. Th2 cytokine levels for these two patients showed no such elevation, and their other 27-Plex biomarkers did not differ significantly from group means. However, CBA tear IL-9 elevation for the two patients was not supported by MS of matching tear samples. MS IL-9 levels were below 100 pg/mL. In addition, conjunctival gene expression of IL-9 and IL-9R for these two patients was not elevated above group means. Tear IL-9 levels for other patients were consistent between CBA and MS.
CONCLUSIONS: Greatly increased and unsubstantiated CBA tear IL-9 values for two study patients suggests assay interference, possibly due to a heterophilic tear antibody recognizing the CBA IL-9 antibodies. The patients were spouses, so an environmental effect may have produced such a heterophilic antibody. Tears from other family members did not show the same CBA interference effect. Caution should be used when interpreting CBA-based tear IL-9 and other biomarker levels in the absence of an independent confirming test.

66. **ASSOCIATION OF SNPS OF IL-17 WITH SUSCEPTIBILITY AND SEVERITY OF CONTACT LENS KERATITIS** (125258)
Nicole Carnt, BOptom, PhD, FAAO, Moorfields Eye Hospital NHS Foundation Trust, Mark Willcox, Fiona Stapleton, MCOptom, PhD, FAAO, University of New South Wales, School of Optometry and Vision Science, John Dart, MA, DM, FRCOphth, Moorfields Eye Hospital

RESULTS: While there was no difference in the genotype distribution between microbial keratitis, sterile keratitis and control groups for both SNPs ($p>0.05$), a higher proportion of cases of severe keratitis carried the mutated G allele of Interleukin 17F rs 2397084, compared to individuals with moderate, mild, sterile keratitis and controls (8/24, 33.3% versus 47/240, 19.6%, $p=0.003$).
PURPOSE: To investigate whether single nucleotide polymorphisms (SNPs) of Interleukin 17 were associated with susceptibility and severity of keratitis in contact lens wearers.
METHODS: : Sixty seven cases of microbial keratitis, 23 cases of sterile keratitis and 185 controls of Caucasian ethnicity were recruited from Microbial Keratitis studies conducted at Moorfields Eye Hospital and nationwide in Australia during 2003-2005. Outcome and severity of keratitis was classified according to the same criteria used in those studies. Buccal swab samples were collected on Whatman FTA cards via post. DNA was extracted with an optimised pH method, amplified with PCR and analysed with Pyrosequencing (Biotage, Sweden). Interleukin 17A (rs2275913) and Interleukin 17F (rs2397084) polymorphisms were investigated with Chi Square analysis for susceptibility (all keratitis and microbial keratitis compared with controls) and severity (mild, moderate, severe microbial keratitis). Statistical significance was set at 5%.
CONCLUSIONS: A single nucleotide missense polymorphism of Interleukin 17F (rs 2397084) that causes the amino acid translation Glu126Gly is found more frequently in

contact lens wearers who experience severe microbial keratitis compared to individuals with less severe forms of keratitis and those without the disease. When challenged microbially, contact lens wearers with this mutation may not be able to clear bacteria as effectively or develop higher levels of inflammation than other wearers, manifesting in more severe disease outcomes.
ADDITIONAL COMMENTS: This study was supported by a 2011 AOF Vistakon Research Grant

67. **ASSOCIATION OF MUC16 IN MUCIN BALL FORMATION** (125457)
Loretta B. Szczotka-Flynn, OD, PhD, FAAO, Tamar Shafran, MD, Case Western Reserve University Dept. of Ophthalmology, Sandra Spurr- Michaud, MS, Ilene Gipson, PhD, Schepens Eye Research Institute

RESULTS: 9 eyes produced <=5 mucin balls and 20 eyes produced > 5 mucin balls ("mucin ball formers", over half produced >=20 mucin balls). The mean MUC16 net intensity per µg total protein in the pellet fraction was significantly greater in eyes that produced > 5 mucin balls compared to those that did not (2,399 vs. 263, p=0.014), however, no positive correlation between numbers of mucin balls formed and MUC16 net intensity existed (p>0.05). No differences were found in the supernatant fraction between the two groups (258 vs. 392; non-mucin ball formers vs. mucin ball formers, respectively; p=0.69).
PURPOSE: Previous studies on the microscopic analysis of mucin balls were not able to differentiate the specific mucin components present. This study assessed whether mucin ball formers and non-mucin ball formers had detectable differences in the relative concentrations of MUC16, a known membrane associated mucin present on the ocular surface epithelium at the tear film interface. The ectodomain of MUC16 is constituitively released into the tear film.
METHODS: 16 subjects successfully completed at least 20 days of continuous wear with lotrafilcon A contact lenses after which the number of mucin balls formed were assessed by slit lamp exam. Immediately after lens removal, eye wash samples were collected from 29 eyes and centrifuged. The supernatant fraction was collected and the pellet fraction was reconstituted in 10 µl RIPA buffer plus protease inhibitor cocktail. Protein content was determined using Pierce MicroBCA protein assay. MUC16 protein content was determined by densitometry of positive bands on western blots and expressed as net intensity per µg total protein.
CONCLUSIONS: MUC16 is detectable in eyewash samples regardless of mucin ball production. However, mean MUC16 protein content is higher in pelleted eye wash samples of mucin ball formers. Mucin balls may be particularly rich in MUC16 mucin composition, perhaps indicating presence of either desquamated cells or an increased amount of released MUC16 ectodomain.
ADDITIONAL COMMENTS: Support: American Optometric Foundation

68. **IN VITRO WETTABILITY COMPARISON OF HYDROGEL AND SILICONE HYDROGEL DAILY DISPOSABLE AND FREQUENT REPLACEMENT CONTACT LENSES** (125032)

Kara L. Menzies, MSc, Lakshman N. Subbaraman, MSc, PhD, FAAO, Lyndon W. Jones, PhD, FAAO, University of Waterloo, Centre for Contact Lens Research

RESULTS: The delefilcon A lens material had significantly lower advancing CAs ($p<0.05$) out of the blister pack (32˚) and after a 24hr soak in PBS (37˚) compared to all the other DD lens materials, except for nelfilcon A ($p>0.99$), which had similar advancing CAs (26˚; 21˚). The receding CAs for nelfilcon A (18˚;18˚), delefilcon A (29˚; 31˚), lotrafilcon A (30˚; 35˚), lotrafilcon B (27˚;35˚), and comfilcon A (25˚;33˚) were statistically lower than all the other lens materials ($p<0.05$).
PURPOSE: Hydrogel and silicone hydrogel (SH) contact lens materials incorporate various techniques to enhance their surface wettability. The purpose of this study was to determine the advancing and receding sessile-drop water contact angles (CAs) of 8 daily disposable (DD) lenses and 7 frequent replacement (FR) lenses using the sessile drop technique.
METHODS: The advancing and receding CAs were measured directly out of the blister pack and after a 24 hour (hr) soak in phosphate buffered saline (PBS) four times each for 8 hydrogel and SH DD lens materials: hilafilcon A, nelfilcon A, omafilcon A, etafilcon A, delefilcon A, narafilcon A, narafilcon B and filcon II 3 and 7 SH FRP lenses: balafilcon A, lotrafilcon A, lotrafilcon B, comfilcon A, enfilcon A, senofilcon A and galyfilcon A.
CONCLUSIONS: Advancing and receding CAs of the CIBA Vision lens materials, including the newest SH DD material (delefilcon A) as well as Cooper Vision's comfilcon A, were significantly lower than the CAs for the other lens materials. The impact of low advancing and receding CAs on clinical comfort requires further investigation.
ADDITIONAL COMMENTS: Financial support for this study was funded by Alcon.

69. **THE MECHANICS OF HIGH WATER CONTENT GELS** (125217)
Thomas E. Angelini, PhD, W. Gregory Sawyer, PhD, Scott Perry, Sherry Huo, Alison Dunn, Juan Urena, University of Florida

RESULTS: At low pressure and strain levels below 0.2, the high water content gels compress linearly. Typical elastic moduli are in the 10 kPa range. Above strains of 0.2, the materials stiffen with the scaling predicted by hydrogel elasticity theory. This suggests that strain stiffening of gels under compression is caused by transiently driving water from the gel and increasing the polymer concentration, thereby increasing the elastic modulus. The elastic modulus was extracted from measurements at high strains. Between strains of 0.2 and 0.5, the modulus dramatically rises from 10kPa to 200kPa.
PURPOSE: The purpose of the work presented here is to determine the linear and non-linear material properties of high water content hydrogels. To improve contact lens comfort, surface gel layers are generated at the surface of silicone-hydrogel contact lenses; high water content (>80%) gels are comparable in stiffness to epithelial cells or to the bound mucin network at the cornea surface. This study examines the elastic modulus of very soft hydrogels as a function of strain to understand the interactions between soft hydrogel coated contact lenses and the eye.
METHODS: Mechanical tests were carried out on single component hydrogels and on

gels at the surfaces of silicone-based contact lenses (DAILIES TOTAL1®). Bulk mechanical properties of single component gels were characterized with macroscopic compression tests, and surface gel layers on contact lenses were measured using colloidal probe indentation. Pressures up to 24 kPa were applied, achieving maximal strains of 0.5.
CONCLUSIONS: High water content surface coatings have very low elastic moduli, comparable to the stiffness of the very tissue for which they are designed to provide comfort. However, above moderate levels of compressive strain, these soft materials stiffen dramatically. Thus, characterization of high water content gels may be misleading at high pressures or after long periods of applied force, in which the material is excessively strained. Interestingly, the high water content hydrogel surfaces are softest at pressures relevant to physiological conditions.

70. COEFFICIENT OF FRICTION AND SOFT CONTACT LENS COMFORT (125603)

Chantal M-L Coles, BS, OD, Noel A. Brennan, OD, PhD, FAAO, Johnson & Johnson Vision Care

RESULTS: The r-squared values for correlation between the comfort scores and co-efficient of friction data at 0, 50 and 100 cycles were 0.74, 0.73 and 0.77 respectively when omafilcon A and polyHEMA were not included. When these other material types were included the r-squared values were 0.90, 0.87 and 0.90, respectively. All were statistically significant at the $p< 0.01$ level. Separate regression analyses including Dk/t, modulus and water content showed that only coefficient of friction remained in the equation as a predictor of comfort.
PURPOSE: In 2009, data were presented to show that contact lens surface coefficient of friction was the only significant contact lens material property that remained in a multiple regression analysis attempting to correlate end-of-day wearing comfort (Brennan and Coles, OVS 2009: 86; e-abstract 90957). Since then, additional data for the co-efficient of friction of contact lenses have been published.
METHODS: The same large database for contact lens comfort that was previously used was applied again. End-of-day comfort values obtained from over 700 separate 1-month wearing trials were derived using a sensitive and sophisticated method (smoothed median). Coefficient of friction data at 0, 50 and 100 cycles recently published by Roba et al (Tribology letters, 2011; 44:387) were used to correlate with the end of day comfort values from the wearing trials. Commercially available lenses made from the following materials were tested in both experiments: balafilcon A, comfilcon A, etafilcon A, galyfilcon A, lotrafilcon B, lotrafilcon A, omafilcon A, polyHEMA, senofilcon A. The lenses made from polyHEMA and omafilcon A were not the same brands in each set so these were included in separate analyses.
CONCLUSIONS: While the coefficient of friction data used here were obtained from a different source using a different methodology to those used in a previous presentation, the conclusion from this analysis reinforces the previous finding that the principal lens property associated with end-of-day comfort is coefficient of friction.

71. **EVALUATION OF TEAR FILM BIOCOMPATIBILITY OF LENS MATERIAL BASED ON IN VIVO NONINVASIVE TEAR FILM SURFACE QUALITY ASSESSMENT** (125173)

Dorota H. Szczesna-Iskander, PhD, D. Robert Iskander, PhD, DSc, Institute of Biomedical Engineering and Instrumentation

RESULTS: No statistically significant differences between morning and afternoon measurements were reported in both methods; hence the am/pm data were pulled. All considered contact lenses worsened individual TFSQ compared to bare eye. Using LSI, the group average decline in TFSQ was the lowest for lens C 16.5±3.9%, and the highest for lens D 39.7±6.1% (mean ± SE). Similar distribution of TFSQ decline, but at a different scale, was obtained using HSV. Although the group averages may appear representative of individual lens order for the majority of subjects, seven subjects (in LSI) and only three (in HSV) had both lens C and lens D as their best and worst case, respectively. Also, for one subject lens A and for two subjects lens B achieved the lowest TFSQ decline. Of particular interest were the interblink TFSQ dynamics that were also found to be subject/material specific.

PURPOSE: To assess the effect of contact lens material on tear film surface quality (TFSQ) and stability in natural blinking conditions, and to establish the utility of two techniques for selecting the optimal contact lens material for an individual subject based on their tear film behavior.

METHODS: Data from a recent study [IOVS; 2012, 53(1): 525-531] were used. In that study, only group trends were sought and reported. In the current study, the individual subject's tear film behavior was examined. 13 healthy subjects were wearing four different commercially available daily disposable lenses that were masked as lens A, B, C and D. Lateral shearing interferometry (LSI) and high-speed videokeratoscopy (HSV) were used for quantitative assessment of TFSQ in the morning and after 8 hours of lens wear. The repeated-measures ANOVA was used for the statistical analyses.

CONCLUSIONS: Noninvasive methods of tear film assessment can be used to evaluate the lens material tear film biocompatibility. Despite some trends, the effect of contact lens material on TFSQ was found to differ from subject to subject suggesting that the tear film biocompatibility is an individual feature.

72. **IN VITRO DEHYDRATION OF HYDROGEL CONTACT LENS MATERIALS UNDER SEVERAL ENVIRONMENTAL CONDITIONS** (125255)

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RESULTS: There were significant differences ($p<0.05$) in VD values among HCLs from minute 5 to 20 of exposure for all the conditions. It was observed that the decrease in RH and the presence of AF accelerates the dehydration in all the HCLs. Stabilization time was sooner during the 5% RH with AF (median: 30) than the 70% RH without AF (median: 60) condition for most HCLs. Senofilcon A obtained the latest stabilization time

for the two most extreme conditions tested. High WC HCLs significantly ($p>0.04$) dehydrated less than low WC HCLs under 70%RH conditions.
PURPOSE: To analyze in vitro the influence of different environmental conditions on the dehydration pattern of seven currently marketed hydrogel contact lenses (HCL).
METHODS: Three conventional HCLs: Omafilcon A, Vifilcon A and Polymacon; and 4 silicone-HCLs: Lotrafilcon B, Balafilcon A, Senofilcon A and Comfilcon A were evaluated in this study. Four different relative humidity (RH) conditions (5, 30, 50 and 70%) and two air flow (AF) rates (0 and 10 ml/min) were used within an environmental chamber. Dehydration was assessed using the gravimetric method. Data were taken at baseline, 5, 10, 15, 20, 30, 45, 60, 90 and 120 minutes of exposure. Valid dehydration (VD) was calculated. Stabilization time (moment where two consecutive VD values were = 2% and the dehydration curve slope was always < 0.1) was obtained for the 2 most extreme conditions (5%RH with AF and 70%RH without AF). HCLs were also grouped by water content (WC) to analyze the environment effect on this parameter.
CONCLUSIONS: The RH decrease and the AF presence increased the dehydration of HCLs, which depended on HCLs material. The present study might show clinicians how current marketed HCLs would behave under different environmental conditions whilst being worn, despite in vitro dehydration is likely to differ from the in vivo one.

73. LUBRICITY IN HIGH WATER CONTENT SURFACE GEL LAYERS (125089)

W. Gregory Sawyer, PhD, Dept. of Mechanical and Aerospace Engineering, University of Florida

RESULTS: The friction coefficients in phosphate-buffered saline is exceptionally low with boundary lubrication values below $\mu=0.010$. The importance of making measurements under ocular conditions is highlighted by the transitions in behavior due to contact pressure and the slightly increased friction coefficient when run in borate-buffered saline, $\mu=0.020$. The gel surfaces were robust to pressure changes under the 18 KPa pressure threshold, and the lubricity was recovered upon a return to low contact pressure sliding.
PURPOSE: To determine the effects of a soft surface gel (water content above 80%) on the lubricity of contact lenses. This gel layer was designed to mimic the corneal epithelium and glycocalyx by acting as a compliant foundation to spread contact, reduce pressure, and promote boundary lubrication. This study examines the friction response of the gel layer under varied pressures and correlates the frictional behavior and frictional responses to the mechanical properties of the gel layer.
METHODS: Gel surface layers (a 5-6 μm thick) were formed on the surfaces of silicone based contact lens. These layers were minimally crosslinked and graded on the anterior and posterior surfaces of the lens. Friction measurements were carried out on a precise micro-tribometer constructed specifically designed to probe low contact pressure sliding in aqueous environments. Experimental soft contact lenses (20) were mounted into a custom conformal holder, placed in a baths of either borate-buffered saline (Unisol) or phosphate-buffered saline, and heated to physiological temperatures. Lubricity experiments were performed at a range of contact pressures (1-10kPa) and sliding speeds (10 μm/s - 600 μm/s).

CONCLUSIONS: Tribological probing of the surface gels indicates that they are compliant but mechanically stable to pressures below 18 KPa. At pressures such as those seen in the eye (3-5 kPa) the gel layers can support smooth sliding and provide a lubricous surface with friction coefficients below μ=0.01. These findings indicate that surface gels can be a route to promote lubricity in contact lenses.

74. **THE APPLICATION OF THE INDENTATION TEST ON THE MEASUREMENT OF MODULUS OF SOFT CONTACT LENS MATERIALS** (125301)

Alexander Leube Leube, BSc, Wolfgang Sickenberger, MS Optom, Dipl Ing (FH) AO, Ernst Abbe University of Applied Sciences, Sebastian Marx, JENVIS Research

RESULTS: The analysis of the confounding factors shows that the achieved modulus measured in saline solution is significant lower in comparison to a conditioned solution ($p<0.001$, t-test) and a blister solution ($p=0.003$, t-test). Measurements of thinner lenses resulted in higher modulus values ($r_{min}=0.781$ $p=0.236$; $r_{max}=0.995$ $p=0.032$). For the use of stacking the standard deviation is rising ($r=0.878$ $p=0.789$, t-test).In every case the modulusof the measured contact lenses were significant different ($p<0.001$, t-test) to the values that are given by the manufacturers. The coefficient of variation ranged from 2% up to 35%.

PURPOSE: To develop a novel, non-destructive method that evaluates the modulus of common soft contact lens materials. In course of this potential confounding factors should be examine.

METHODS: According to the instrumented indentation test (ISO 14577) a micro-hardness tester (Fischerscope HM2000) was used to measure the modulus of softcontact lenses. To evaluate the confounding factors, measurements with three different fluids (saline, blister and conditioned solution) and contact lenses of different thicknesses were performed. Also the influence of stacking (different numbers of lenses above each other) was examined. To get comparable values of market leading soft contact lenses the modulus of five different monthly and three different daily disposable lenseswith the power of +6D were examined by using fully hydrated conditions.

CONCLUSIONS: For all market leading contact lenses the indentation test was applicable. Several confounding factors were examined and described. The study provides comparable values for the modulus of all common soft contact lens materials. These measurements were performed under fully hydrated conditions the first time.

ADDITIONAL COMMENTS: This study was accomplished without any financial support.

75. **ACANTHAMOEBA FEEDING ON CONTACT LENS STORAGE CASE ISOLATES AND BACTERIA SURVIVAL WITHIN THE AMOEBIC CYST STAGE** (125649)

Anthony Lam, BS, Abbott Medical Optics Inc., Simon Kilvington, University of Leicester

RESULTS: A. castellanii trophozoites fed and rapidly replicated with equal migration (>75 mm) with all strains of Achromobacter spp., Delftia spp., Stenotrophomonas

maltophilia, E. coli, Serratia marcescens, Elizabethkingia spp., and Sphingobacterium spiritivorum. However, Chryseobacterium indologenes growth was poor. For A. polyphaga, reduced growth rates were observed with S. marcescens, Achromobacter sp., and C. indologenes. Achromobacter sp., S. maltophilia, E. coli and S. marcescens survived within A. castellanii cysts following HCl treatment and subsequent CL disinfection.
PURPOSE: Acanthamoeba keratitis is a rare but potentially blinding infection with contact lens (CL) wearers. CL storage cases (CLSC) can become rapidly and persistently contaminated with bacteria and provide a food source for Acanthamoeba. Growth rates of Acanthamoeba trophozoite feeding on CLSC bacteria and their survival within the resistant cyst stage of the amoeba was investigated.
METHODS: Bacteria from CLSC and Escherichia coli were seeded on non-nutrient agar plates and inoculated with cysts of A. castellanii or A. polyphaga. Plates were incubated and the rate of trophozoite feeding (following excystment) across the plates. A. castellanii cysts which were formed on the plates after 7d, were harvested and submerged in hydrochloric acid for 24 hr killing free bacteria, trophozoites and immature but not mature cysts. Cysts were washed and incubated in broth medium. Here, viable cysts hatch and emergent trophozoites release surviving bacteria which multiply in broth. In other studies, co-cultured, acid treated cysts were exposed to CL disinfectant solutions: (PQ1 + PHMB) and (PQ1 + MAPD, 6 ppm) for 24 hr before excystment.
CONCLUSIONS: CLSC contaminants can support the growth of Acanthamoeba and may serve as a food source for the organism in the development of amoebic keratitis. Survival of bacteria within Acanthamoeba cysts may allow protection from disinfection and aid environmental dispersal and colonisation.

76. **SORPTION OF RADIOLABELED LIPIDS ON SILICONE HYDROGEL CONTACT LENSES** (125116)
X. Michael Liu, PhD, William Pitt, PhD, Krystian Perez, PhD, Preston Tam, Joseph Chinn, PhD, E Maziarz, PhD, Bausch+Lomb Inc.

RESULTS: Generally, less DPPC than CH sorbed on lenses ($p<0.001$). Sorption of either lipid on Oasys lenses was generally less than on PureVision and Biofinity, which were similar. PureMoist and Biotrue inhibited sorption of the lipids relative to BBS only on Oasys ($p<0.05$). For example, CH sorption on lenses pre-soaked with solutions A, B, and C are 7.4+/-0.1, 5.6+/-0.3 and 5.2+/-0.5 (95%CI).
PURPOSE: Chromatographic methods can measure sorption of multiple lipids to lenses but sometimes lack precision to adequately discriminate between lenses. Therefore we developed protocols using radiolabeled cholesterol (CH) and dipalmitoylphosphocholine (DPPC) to quantify with precision and accuracy their sorption on contact lenses. In this study, we measured the ability of 2 commercial multipurpose solutions (MPS) to prevent lipid sorption on 3 commercial lenses.
METHODS: Synthetic tear solution (TS) contained the following (conc. in mg/mL) CH 0.032, DPPC 0.032, methyl-β;-cyclodextrin 0.08, cholesteryl linoleate 0.066, oleic acid 0.004, methyl oleate 0.088, triolein 0.01, lysozyme 0.0265, lactoferrin 0.0358, albumin 0.087, mucin 0.1 in borate buffer (pH 7.3). 0.81% of DPPC had H-3 label, and 4.98% of CH had C-14 label. Lenses (A, Acuvue Oasys, Vistakon; B, PureVision; B&L; B,

Biofinity, CooperVision) were blotted dry, then soaked 16hr in MPS or control solution (A, borate buffered saline, BBS; B, OPTI-FREE PureMoist, Alcon; C, Biotrue, B&L). Next, lenses were incubated with TS for 16h at 37°C. After 3 serial n-propanol extractions of 6 to 8 lenses, sorption was quantified by scintillation counting.
CONCLUSIONS: EOBO surfactant is reported to inhibit lipid sorption on some but not all lens types based upon experiments with fluorescently labeled lipids (ARVO 2010 Poster 3426/D1043; US Patent Application 12/831890). Fluorometric methods can be problematic, since label on the lipid may interact with lens and solutions. Our study using radiolabels suggests that surfactants and other components present in the 2 MPS tested can reduce lipid sorption on some lenses.

77. **INDIRECT TRANSMITTANCE OF A CONTACT LENS IN A WET CELL WITH AN INTEGRATING SPHERE** (125560)

Claude J. Giasson, OD, PhD, FAAO, Corinne Deschenes, Hana Shamieh, Vasile Diaconu, PhD, University of Montreal School of Optometry

RESULTS: At 544 nm, average S1, S2 and S3 were respectively: 0.279, 2.627 and 2.892 counts. The contribution of the contact lens was 0.265, representing a ratio of 10.2% of the indirect transmittance of the wet cell and saline. The average indirect transmittance of the wet cell filled (S2-S1: 2.348) was significantly different from the one of the wet cell plus the contact cell (S3-S1: 2.613) with an independent t test (p 0.000) at 544 nm.
PURPOSE: Compare the indirect transmittance of a system of contact lens- wet cell to the one of the wet cell alone in order to calculate the contact lens indirect transmittance. According to ANSI, the transmittance of an immersed contact lens should be measured with an integrating sphere (IS) in order to include its indirect transmittance (scatter).
METHODS: The indirect transmittance of a wet cell filled with saline and with a contact lens (Cooper Vision, Enfilcon, Dia 14.2 mm, -3.00D., BC:8,5) were measured 5 times with a spectrophotometer (Cary 5000, Varian) equipped with an integrating sphere without a diffusing reference plate in the range of 400 to 700 nm. After a measurement of background (S1), a quartz chamber containing saline solution was placed to measure its indirect transmittance (S2), after which a contact lens was added into the cell before the measurement (S3). The indirect transmittance of the wet cell filled with saline only (S2-S1) was compared with the one of the wet cell plus the contact cell (S3-S1) with an independent t test at 544 nm.
CONCLUSIONS: In our system, the indirect transmittance of a contact lens with an integrating sphere represented a maximal percentage of 10% of the indirect transmittance (scatter) of the wet cell alone. Therefore the measurement of the indirect transmittance of a contact lens in a wet cell is a measurement where the signal to noise ratio is decreased. An in vivo measurement of transmittance of a contact lens in situ would be ideal because it would be more similar to the conditions occurring during contact lens wear.
ADDITIONAL COMMENTS: CIHR summer student grant to CD

78. **MUCOMIMETIC SILICONE HYDROGEL CONTACT LENSES: A HIGHLY LUBRICIOUS SURFACE ENHANCEMENT** (125307)

Alonzo Cook, PhD, Matthew Skinner, Jun Li, Karen Schultz, Christopher Loose, Zheng Zhang, Semprus Biosciences

RESULTS: The advancing DCA of polybetaine-modified PremiO lenses was reduced by 71% ($p << 0.001$). The DCA hysteresis was reduced to zero ($p<<0.001$). The COF of polybetaine-modified Air Optix™ Aqua lenses was reduced by 62% ($p<0.004$). The surface modification had no substantial effect on the bulk properties including clarity, power, oxygen permeability, dimensions, and mechanical properties. The modification was stable to autoclave sterilization and an aggressive cleaning regimen.
PURPOSE: Polybetaines are stable, mucomimetic polymers that reduce protein deposition and enhance surface wettability. Semprus has developed lubricious polybetaine-modified silicone hydrogel (SiHy) contact lenses. The polybetaine modification may decrease friction between the anterior surface of the contact lens and the inner eyelid, create a more stable tear film, and improve end-of-day comfort for contact lens wearers.
METHODS: Commercially available SiHy lenses were surface-modified using a one-step controlled polymerization process. Control lenses were unmodified commercially available lenses after removal of residual packaging solution components. Surface properties were analyzed with dynamic contact angle (DCA) using an underwater captive bubble method, and coefficient of friction (COF) measurements in linear reciprocating mode at 0.1 Hz for 50 cycles. The durability of the modification was evaluated after autoclaving and after aggressive cleaning using a 3% hydrogen peroxide regimen for 30 cycles.
CONCLUSIONS: Polybetaine surface modification is very durable and substantially enhances the wettability and lubricity of SiHy lenses without affecting bulk properties. The advancing DCA, hysteresis and COF were significantly decreased. The potential for this technology is to provide enhanced surfaces on SiHy lenses that are able to spread and maintain a tear film, reduce friction with the inner eyelid, and improve comfort for the duration of wear.
ADDITIONAL COMMENTS: Studies were performed and funded by Semprus BioSciences Corporation (Cambridge, MA). FDA has not evaluated the product or its claims.

79. CORNEAL WAVEFRONT ABERRATIONS IN PATIENTS WEARING MULTIFOCAL SOFT CONTACT LENSES FOR MYOPIA CONTROL (125092)

Frank Spors, Jie Shen, Donald Egan, OD, FAAO, Lance McNaughton, OD, FAAO, Stuart Mann, OD, MA, FCOVD, Neil Patel, Western University of Health Sciences College of Optometry

RESULTS: Statistically significant changes in higher order aberrations were detected for lenses of all reading additions. Lens groups with higher Add-powers demonstrated stronger changes with increased significance. Final RMS values relating to 2nd, 3rd and 4th Zernike Orders reached clinical significance with a wavefront error of 0.10μm, the equivalent of 0.25D. Moreover, as Add-powers increased, 3rd and 4th order aberrations likewise showed an increase. Pre-fitting astigmatism values accounted for the highest recorded aberrations and remained predominantly unchanged.

PURPOSE: The purpose of this study was to evaluate the change in corneal wavefront aberrations in young adults who have been fit with multifocal soft contact lenses for myopia progression control. Findings have been analyzed for statistical significance and clinical relevance and compared to reportedly successful Orthokeratology outcomes.
METHODS: The dominant eye of 40 participants (27 women, 13 men; mean age 27.3 ±3.2 years; range 23 to 39 years) was fit with Proclear Multifocal center distance lenses (Coopervision, Pleasanton, USA) having a variety of distance powers and reading additions. Refractive errors were limited to a range of -6.00 D up to +1.00 D of sphere, and no greater than -1.00 D of cylinder. Corneal wavefront measurements were performed over 6 mm diameters with a Zeiss Atlas 9000 corneal topographer (Zeiss Meditec, Dublin, USA) prior to, and following lens fitting. Data were converted into rectangular Fourier optics terms and RMS values for each reading addition were statistically analyzed. Following evaluation of statistical significance and clinical relevance, results were compared to published data from successful Orthokeratology treatments.
CONCLUSIONS: Proclear Multifocal center-distance contact lenses were found to increase higher order wavefront aberrations in a manner dependent on their Add-power. In comparison to successful Orthokeratology outcomes, the amounts of resulting aberrations are notably different.

80. **OCULAR ABERRATIONS AND VISUAL PERFORMANCE IN PRESBYOPIC PATIENTS FITTED WITH THREE MULTIFOCAL SOFT CONTACT LENSES** (125558)

Daniela Lopes-Ferreira, Helena Isabel Neves, Leticia Isla-Paradelo, Jose Manuel Gonzalez-Meijome, Clinical & Experimental Optometry Research Lab Center of Physics School of Science

RESULTS: Forth-order spherical aberration (Z4,0) at 15 days in dominant eye was 0.012±0.05mm, -0.019±0.04mm and 0.073±0.05mm with Oasys, Optix and Proclear respectively with differences being significantly more positive for Proclear ($p<0.01$) compared with Oasys and Optix. In non dominant eye at 15 days Z4,0 was 0.025±0.04mm, -0.045±0.03mm and -0.007±0.06mm with Oasys, Optix and Proclear respectively being significantly more positive for Oasys than for Optix ($p<0.001$). Positive correlation between SA and distance high contrast VA was founded for dominant eye with Optix ($r=0.360$, $p=0.013$) and negative correlation between secondary spherical aberration and high contrast distance visual acuity ($r=-0.510$, $p=0.038$) in non dominant eye with Proclear
PURPOSE: Evaluate the aberrations induced by different multifocal contact lenses in presbyopic patients after 15 days of lens wear and their correlation with visual performance at distance and near
METHODS: Nineteen presbyopic patients were included in this study (mean age 48.6±3.54) with a mean addition of 1.53± 0.47D. Mean spherical equivalent and photopic pupil size was not statistically different between dominant and non-dominant eye

(p>0.05). Patients were fitted with AirOptix Multifocal, AcuvueOasys for Presbyopia and Proclear Multifocal. Visual acuity (VA) and ocular aberrations were measured at baseline, dispensing day (day 1) and after 15 days with LogMAR ETDRS (Precision Vision) for distance (4 meters) and for near (40 centimeters) under high (100%) and low (10%) contrast under photopic conditions (85 cd/m2). Aberrations were obtained with Hartmann-Shack aberrometer (IRX3, Imagine Eyes, France) and analyzed for fixed 4 mm pupil size
CONCLUSIONS: On-eye higher-order aberrations induced by multifocal soft contact lenses in presbyopic eyes are dependent on each multifocal optical design and correlate differently with visual performance
ADDITIONAL COMMENTS: Supported by a grant PTDC/SAU-BEB/098392/2008) from the science and technology foundation of Portuguese Ministry of Science and Superior Education

81. **TEAR OSMOLARITY AND SUBJECTIVE OCULAR DRYNESS IN CONTACT LENS WEARERS** (125492)

Pauline Xu, BOptom, Percy Lazon de la Jara, PhD, Thomas Naduvilath, MSc, Kassandra Wagenfuehr, Eric Basil Papas, PhD, MCOptom, FAAO, Brien Holden Vision Institute

RESULTS: There was a significant increase in ocular dryness at 8 hours with CL wear compared to pre-insertion (0.5±1, p=0.003), but not with no-lens wear (0.3±1, p=0.27). TO increased significantly from dispensing to 8 hour with CL (9.2±12.7 mOsm/L, p=0.001) and without CL wear (12.5±14.8 mOsm/L, p=0.002). TO readings were not significantly different between lens types. However, no correlation was found between ocular dryness ratings and TO values throughout the course of the day (p=0.93). The percentage of participants with TO >308 mOsm/L increased from 2.6% at dispensing to 21.1% at 8 hours in the lens wearing stages (p=0.016), no significant increase was observed in the no-lens wear stage (p>0.05). Based on the CLDEQ-8, px were classified as having no (28%), marginal (17%) and with dry eye symptoms (56%). Classifications could be discriminated based on dryness rating both with (p<0.01) and without lens wear (p=0.03). Discrimination of CLDEQ-8 classifications was not attained with TO values.
PURPOSE: The association of tear osmolarity (TO) with dryness symptoms has been equivocal (Nichols et al,2006, Stahl et al,2009). The purpose of this study was to investigate the symptoms of ocular dryness and TO with and without CL wear
METHODS: Experienced contact lens (CL) wearers (n=20) were recruited in a 3-stage study: one with a conventional hydrogel, one with a silicone hydrogel and one with no lens wear. The order of the stages was randomized. For each stage, lenses were worn bilaterally for ≈8 hours. Participants (px) were classified using questions on frequency and late-day intensity of dryness in the CLDEQ-8 questionnaire. During each stage, px rated their ocular dryness in a 1-10 scale prior to lens insertion, and at 1 hour and 8 hours of wear. TO was measured in one randomly-chosen eye with a TearLabTM osmometer after dryness rating. Data were analysed using paired t-test and McNemar test
CONCLUSIONS: Perhaps due to wide inter-subject variability, the results suggest that the increase in osmolarity and dryness rating through the day is not different between lens wear and no lens wear

82. **PATIENT ADHERENCE TO CL REPLACEMENT SCHEDULE** (125609)
Giovanna E. Olivares, OD, FAAO, Anne Jedraszczak, MA, Jordin Alford, MBA, Vistakon

RESULTS: On average the data represented 4 to 9 replacement cycles. The results show that patient behavior, as it pertains to replacing lenses on a specific day of the week or date of the month, was not consistent. Of patients with Manufacturer Recommended Replacement Frequency (MRRF) of 1-2 weeks, only 8% of replacements occurred on the 1st of each month. Replacement of lenses was scattered throughout the month showing no consistent pattern with respect to date or day. Patients wearing lenses with a MRRF of 1 month replaced the lenses on the 1st of the month only 28% of the time. Again patient behavior showed replacement of lenses was scattered throughout the month showing no consistent pattern with respect to date or day.
PURPOSE: To understand patient behaviors as it pertains to lens wearing time and the replacement of their contact lenses
METHODS: A masked internet survey was administered to 804 spherical reusable hydrogel and silicone hydrogel contact lens (CL) wearers in the USA for 18 weeks covering 4,160 lens replacements. Over these multiple replacement cycles, patients recorded the exact dates that they replaced their lenses within weekly diary surveys administered online. Brand use verification was established by ECP identification or UPC code validation. CL wearer satisfaction, wear experience and use were surveyed. Self-report of agreement with statements was analyzed across CL Modality and Brand using All-Pairs statistical tests, with $p<0.05$ considered significant
CONCLUSIONS: The data of this study shows that patient adherence to a prescribed CL replacement schedule (i.e. replacing at the 1st of the month) is variable with patients replacing lenses throughout the month. In the last few years, many have suggested a simplistic solution such as replacing the lenses at the first of the month as an easy answer to patient compliance. The recorded replacement behavior of the patients in this study would indicate that this is not a solution with high success. In order to attain better adherence to a CL prescribed regimen,extensive patient education or external reinforcement such as electronic reminders may be needed.

83. **DAILY DISPOSABLE HYDROGEL LENSES: IMPACT ON FREQUENCY OF SCHEDULED AND UNSCHEDULED CLINIC VISITS** (125408)
Sheila B. Hickson-Curran, BSc(Hons), MCOptom, FAAO, Jordin Alford, MBA, Vistakon Johnson & Johnson Vision Care Inc.

RESULTS: The study sample consisted of 588 daily disposable patient charts. The average time between annual visits was 14.5 months (median 12.7 months). Over the study period (3 years) 11% of daily disposable lens wearers returned for an unscheduled visit due to clinical complaints related to contact lenses, including comfort or vision complaints. DD lens Brand had an impact on unscheduled visit rates (ACUVUE Brands 6%, CIBA DAILIES Brands, 15% ($p<0.05$). Annualized rates of unscheduled visits were very low at only 0.11, on average, per year overall (ACUVUE Brands 0.03 visits per year, CIBA DAILIES Brands 0.10 visits per year).
PURPOSE: We previously reported the frequency of scheduled and unscheduled clinic

visits for contemporary reusable contact lenses (AAO 2010 poster). This study examines the frequency of unscheduled clinic visits and scheduled eye examinations for contemporary daily disposable (DD) spherical hydrogel lens wearers.
METHODS: 100 US doctors, representative of private and retail practice, participated by selecting and reviewing DD patient charts prospectively as eligible patients attended their clinic. Chart review was then retrospective over the previous time period starting at the current eye exam and back three years. Charts were reviewed for scheduled examination frequency and unscheduled visits due to clinical complaints related to contact lens performance.
CONCLUSIONS: Patients prescribed DD returned regularly for scheduled eye examinations. Most remain trouble-free, with very low rates of potentially disruptive unscheduled clinic visits due to clinical complaints related to their contact lenses.
ADDITIONAL COMMENTS: The authors are employed by Vistakon, Johnson & Johnson Vision Care, Inc

84. **THROUGH FOCUS CURVES WITH THREE DIFFERENT MULTIFOCAL CONTACT LENSES** (125137)

Jose Manuel Gonzalez-Meijome, Leticia Isla-Paradelo, Daniela Lopes- Ferreira, OD, MSc, Helena Neves, OD, Antonio Queiros, OD, PhD, David Madrid-Costa, OD, PhD, Clinical & Experimental Optometry Research Lab Center of Physics School of Science

RESULTS: The three lenses showed a robust behavior for intermediate vergences up to -1.5D (67 cms) without statistically significant changes in VA ($p>0.05$) being also marginally clinical significant (less than 1 line of difference). Acuvye Oasys had a significantly worse performance at far and intermediate distances while Air Optix showed the best performance for near under natural pupil conditions ($p<0.001$). A reduction of pupil size to 4 mm improved significantly the near vision of Proclear to the same level as Air Optix, both being significantly superior to Acuvue Oasys ($p<0.05$). High add patients with Proclear and Oasys showed worse performance at intermediate and near vergences, while Air Optix was more consistent irrespective of the patient's add ($p<0.05$).
PURPOSE: The purpose of this study was to quantify the through-focus visual performance of 3 multifocal soft contact lenses in presbyopic patients.
METHODS: Nineteen healthy subjects (6 women and 13 men) with mean age of 48.6 ± 3.7 years participated in this cross-over, randomized, double-blind study. Each patient wore three different multifocal contact lens in random order: aspheric design (Air Optix Multifocal), multizone concentric (Acuvue Oasys for Presbyopia) and asymmetric design (Proclear Multifocal) for 15 days period, followed by a one week period of wash-out. Through-focus visual performance was measured for vergence distances of +1.00 to -3.00 in 0.50D steps, in random order under the same conditions using the Functional Vision Analyzer (StereOptical, IL, USA) at a luminance of 85cd/m2 for the natural pupil of the patient and for artificial pupils of 4 and 2 m and separately for high and low add power.
CONCLUSIONS: The combination of pupil size along with lens add and optical design in modern multifocal soft contact lenses renders significantly different visual performance at different distances.

ADDITIONAL COMMENTS: Funded by FCT (Portugal) Projects PTDC/SAU-BEB/098392/2008 and PTDC/SAU-BEB/098391/2008

85. SUBJECTIVE COMFORT COMPARISON OF NARAFILCON B AND OMAFILCON A: DAILY WEAR LENS STUDY IN AN ADULT POPULATION (125996)

Rebecca Hanna, Katerin Ortiz, OD, Inter American University of Puerto Rico

RESULTS: Surveys were collected from the 15 subjects who completed the study. Eight out of 15 or 53.3% preferred Omafilcon A at the end of the first day (P=0.5930). Eight out of 15 or 53.3% preferred Narafilcon B at the end of 7 days of wear and for overall comfort (P=0.5930). In addition, both lenses had improved rose bengal staining at the end of the 7 days.
PURPOSE: 1-DAY ACUVUE TruEye (Narafilcon B) Brand is the first and only daily disposable lens made with silicone hydrogel material. Proclear 1-Day (Omafilcon A) is an established daily disposable hydrogel lens on market. This study compares the subjective preference of these two lenses in an independent, head-to-head comparison.
METHODS: Seventeen subjects were successfully fit with the two brands of daily disposable contact lenses. Selected patient were existing contact lens wearers who did not have any current ocular contraindications. Each patient served as its own control using one eye for the Narafilcon B lens and the other for the Omafilcon A lens. This was a double blind study in which neither the patient nor the investigator knew the identity of the lens material. Participants filled out a pre-study questionnaire then had a comprehensive contact lens fit, which included keratometry, corneal health assessment with fluorescein, rose bengal, tear break up time, lacrimal lake volume, proper lens fit/movement and visual acuity measurement. Participants wore the lenses for 7 consecutive days for 10 hours each day and then returned to the IAUSO clinic for a follow up evaluation which consisted of corneal health assessment with fluorescein, rose bengal, tear break up time and visual acuity after the trial. Lastly participants turned in the 7 day survey which evaluated subjective comfort, ease of lens handling and overall preference.
CONCLUSIONS: The study found that Omafilcon A is as comfortable as Narafilcon B at the end of 7 days of wear. The authors hope this study will assist practitioners as they consider which daily disposable contact lens is best for their patients.

86. LARGE SCALE SURVEY OF SATISFACTION AMONG CURRENT SENOFILCON A CONTACT LENS WEARERS (125443)

Anna Sulley, BSc, MCOptom, FAAO, Anne Madec-Hily, Johnson & Johnson Vision Care UK, Rachel Packe

RESULTS: 89% (±2%) rated the lens as the most comfortable they had worn (n=1,138). 8 out of 10 agreed that even towards the end of day, their lenses feel like they're not wearing any CLs at all (79% (±2%)). 92% (±1%) of senofilcon A wearers would recommend the product to other CL wearers with 82% (±1%) recommending their practitioner as a result of being prescribed the lens.

PURPOSE: To summarize recent research conducted among senofilcon A (ACUVUE® OASYS®, Johnson & Johnson Vision Care, Inc) contact lens (CL) wearers to identify the sources of satisfaction with their lenses in key areas including comfort, vision and, as a consequence, their likelihood to recommend their CLs and practitioner to others.
METHODS: Senofilcon A wearers (spherical n=1207, for astigmatism n=316) across 6 European countries (France, Germany, Italy, Poland, Russia & UK) were surveyed by an independent market research agency online in February and March 2012 about their experience with the CL (in Poland, survey was via computer aided self completion interviews). The research was conducted using panel providers to source the representative sample, with no quotas set on gender or age. Screening was conducted to ensure respondents were wearing the correct lens. Additional screening was applied for Poland and Russia to ensure an economically viable sample. In each of the two product groups, equal weightings across countries were applied to total sample data.
CONCLUSIONS: The results from a large scale survey of senofilcon A wearers reiterates the findings of previous clinical studies – that the lens offers high levels of overall satisfaction. When CL wearers are fitted with such a product not only are they highly likely to continue wearing their lenses to help minimize lapsing, but it may also result in greater loyalty to their practitioner for return visits and in practitioner recommendation to friends and family to increase practice growth.
ADDITIONAL COMMENTS: Study supported by Johnson & Johnson Vision Care UK

87. **COMPARATIVE STUDIES OF HYALURONAN IN COMMERCIALLY AVAILABLE OPHTHALMIC PRODUCTS** (125004)
X. Michael Liu, PhD, Patricia Harmon, BS, E. Peter Maziarz, PhD, Mohinder M. Merchea, OD, PhD, FAAO, Bausch+Lomb Inc.

RESULTS: HA found in the human tear film typically has high molecular weight (greater than one million Daltons). Of all products tested, the molecular weight of HA in Biotrue™ MPS is the closest to that of HA in human tears. Two-sample t-tests were used to compare the molecular weights of HA in each of the products with the molecular weight of HA in Biotrue™ MPS. The molecular weights of HA in each of the other products were statistically significantly lower than that of HA in Biotrue™ MPS ($p<0.05$).
PURPOSE: Much research has indicated that there is a correlation between the molecular weight of hyaluronan and biocompatibility including comfort and anti-inflammatory activity. In this research, we characterized and compared the molecular weights, molecular weight distributions, and concentrations of hyaluronan present in a series of commercially available HA-containing ophthalmic products.
METHODS: On-line size exclusion chromatography with triple detection was used to determine the molecular weights and concentration of HA in commercially available products, including marketed contact lens multipurpose solutions and contact lens packaging solutions. Eight commercially available HA-containing ophthalmic products, were characterized and compared.
CONCLUSIONS: Size exclusion chromatography with triple detection proves to be an effective tool to characterize HA-containing ophthalmic products. The molecular weights of HA used in Biotrue™ multi-purpose solution were found to be similar to those of HA

found in human tears. The molecular weights of HA used in all the other multi-purpose solutions, eye drops, and contact lens packaging solutions tested were determined to be statistically lower than those of HA in Biotrue™ MPS ($p<0.05$). The biological and physical benefits of high molecular weight HA are reported to include protection of corneal epithelium, comfort enhancement, and anti-inflammation. The molecular weight of HA used in ophthalmic products may impact clinical performance.
ADDITIONAL COMMENTS: This work is sponsored by Bausch & Lomb, Inc.

88. **A NOVEL APPROACH FOR DATA COLLECTION EVALUATING DOCTOR AND PATIENT PREFERENCES FOR WEARING A DAILY DISPOSABLE CONTACT LENS FOR ASTIGMATISM** (125405)
W. Lee Ball, OD, FAAO, Vistakon

RESULTS: Of surveys collected, 67% (222) were completed using a smart phone app vs. 20% (65) online website and 13% (46) facsimile. Doctors and patients were given five possible choices about their reason for choosing a DD contact lens for astigmatism. Of these reasons, doctor responses were 26% health, 23% comfort, 23% convenience, 18% vision and 10% lens you wear/trust. Patient responses were 30% convenience, 24% comfort, 24% health, 19% vision, and 3% lens you wear/trust.
PURPOSE: To report a novel approach using smart phone apps to collect data from participating doctors and patients during an In Market Assessment (IMA) and to report doctor and patient preferences for using a daily disposable contact lens for astigmatism.
METHODS: Seven hundred doctors were invited to participate in an IMA for a new contact lens product and asked to give feedback on product performance via a survey. Ninety-four doctors fitting 333 patients with the product participated in the survey and were given the following response method options: smart phone app, online website or facsimile. The survey was conducted in the USA and questioned both doctor and patient respondents about their reason for choosing a daily disposable (DD) contact lens for astigmatism.
CONCLUSIONS: Doctors preferred using a smart phone app to complete surveys compared to more traditional methods. Patients' reasons for choosing a DD contact lens for astigmatism ranked differently than doctors' reasons. Doctors chose health more often as the reason for wearing a DD contact lens for astigmatism while patients chose convenience. It is important to understand which benefits of DD contact lenses may resonate best with patients when discussing the attributes of this wear modality and how patient perceptions may differ from doctors.

89. **UV: WHAT YOUR PATIENTS DON'T KNOW** (125448)
Anna Sulley, BSc, MCOptom, FAAO, Sule Sencer, David M. Ruston, FCOptom, DipCLP, FAAO, Johnson & Johnson Vision Care UK

RESULTS: Whilst over 90% of the sample agreed that it was important to protect both their skin and eyes from UV radiation, only 26% in UK and 66% in Poland were aware that there are CLs that help block UV radiation. 92% felt that they were most at risk in the summer months but 46% agreed being in the sun did not worry them. Only 26% were

aware that cataracts were linked to chronic UV exposure. There was also a greater UV awareness and receptivity in Poland compared to the UK.
PURPOSE: A primary role that Eye Care Professionals perform is to make their patients aware of avoidable risks to their ocular health. Research into patients' understanding of implications of chronic UV exposure was conducted to see how this relates to communication imperatives for their practitioners.
METHODS: Contact lens (CL) wearers (400 in UK, 300 in Poland) and CL considerers (302 in Poland) were surveyed online in 2011 to understand their views on the implications of chronic UV exposure, the risks of UV radiation on their ocular health and on the role of UV blocking CLs in ocular UV protection.
CONCLUSIONS: Although consumers in Europe claim to be aware of UV and its implications, few understand the impact to eyes and the benefits comprehensive ocular UV protection, including UV-blocking CLs, to help protect their eyes. Consumers associate UV primarily with summer and sunny conditions, with few actively protecting against UV, despite a high level of interest in trying UV-blocking CLs. The ignorance of the all day and all year long risks posed by UV, and the options available to block radiation, indicate a need for practitioners to improve communication methodologies on UV radiation and the eye. CL and spectacle lens manufacturers must also play their part in raising public and practitioner awareness concerning this public ocular health hazard. The greater UV awareness in Poland may be due in part to the consistent investment in consumer and professional education on UV radiation since 2004.
ADDITIONAL COMMENTS: Study sponsored by Johnson & Johnson Vision Care UK

90. **FITTING GUIDELINES AND CHARACTERISTICS OF DELEFILCON A LENSES** (125359)
Timothy A. Giles, John Pruitt, Joachim Nick, Dipl Ing (FH) Augenoptik, Erich Baumann, OD, Alcon Research Ltd

RESULTS: A total of 20 subjects, 55% female and 45% male with the average age of 43.6 ± 13.0 years, were fit with the delefilcon A lenses. The mean lens fit score ranged from 0.2 after 2 minutes to -0.6 after 20 minutes to -0.2 after 8 hours on a 9 point scale of 0=optimal, +4.0=unacceptable loose, and -4.0=unacceptable tight. The optimal fitting time was observed at 10 minutes (0.1) and 15 minutes (0.0). The mean values for lens movement in primary gaze ranged from 0.17 mm to 0.22 mm and the mean values for lens movement in up-gaze were in the range of 0.26 mm 0.33 mm. The mean lens centration score ranged from 0.3 to 0.5 on a 5 point scale (0=centered and 4=severe decentration). On a 10-point scale, 0=poor and 10=excellent, overall comfort was rated high at all time intervals and after 8 hours of wear the rating for overall comfort was 9.7±0.6 and for overall vision quality was 9.6±1.5.
PURPOSE: To provide fitting guidelines and recommendations regarding optimal time to evaluate overall lens fit, movement, and centration of a unique water gradient silicone hydrogel daily disposable contact lens, delefilcon A (DAILIES TOTAL1).
METHODS: This was a prospective, bilateral, single group, subject-masked study in which subjects received delefilcon A lenses to wear on both eyes. The contact lens fit, movement, centration and comfort ratings were assessed at time intervals of 2 minutes, 5

minutes, 10 minutes, 15 minutes, 20 minutes, 30 minutes, 1 hour, 3 hours, 6 hours, and after 8 hours of lens insertion by two independent clinicians at two separate sites.
CONCLUSIONS: The study demonstrated that delefilcon A lenses have optimal fitting qualities, including lens movement, centration, and corneal coverage, and were consistent within the time of assessment. The minute variability in lens fitting attributes at all measured intervals suggests that delefilcon A lenses have a great stability within minutes of its application. However, the best time to evaluate and assess the lens fit based on mean lens fit scores was between 10 minutes and 15 minutes of wear.

91. **LID ASSESSMENT: SUBJECTIVE GRADING VS. OBJECTIVE MEASUREMENTS** (125528)

Michel Guillon, FAAO, Cecile A. Maissa, PhD, Stephanie Wong, Anna Lane, Trisha Patel, Richard Bassett, Optometric Technology Group, Renee J. Garofalo, OD, FAAO, Alcon Research Ltd

RESULTS: Subjective gradings produced data crowding for all parameters with a preponderance of responses for only two grades leading to relatively poor sensitivity (hyperaemia Grades1&2 Visit 1=13&52%, Visit 2=10&67%; staining upper lid (UL) G2&3 V1=23&65%, V2=14&70%; staining lower lid (LL) G2&G3 V1=22&59%, V2=17&64%). The repeatability of the subjective gradings was average with limited grading agreement (Identical grades: hyperaemia 68%, staining UL 57% LL 61%; Kappa: hyperaemia =0.434, staining UL=0.130 LL=0.295). In contrast, the repeatability of objective measurements of eyelid hyperaemia was excellent (mean: V1=28.3% V2=29.0%; 95% CI -1.2% to +2.6%, p=0.476) and that of lid margin staining good (LL mean: V1=6.3mm² V2=7.3 mm²; 95% CI -0.3% to +1.8%, p=0.005 & UL mean V1=6.8mm² V2=7.2 mm²; 95% CI -0.5% to +1.2%, p=0.412).
PURPOSE: The objectives of the analysis were to quantify the sensitivity and repeatability of the clinical evaluation of eyelid tissues using subjective grading scales and to compare these with objective measurements from digital photographs.
METHODS: Three groups were enrolled in the study: asymptomatic non-contact lens wearers, asymptomatic and symptomatic Acuvue Oasys and PureVision contact lens wearers. The eyelid parameters evaluated were hyperaemia, papillae and eyelid margin staining. The parameters were graded subjectively using established forced choice scales and measured objectively from digital photographs. The assessment was carried out at two separate visits to assess the parameters test-retest repeatability.
CONCLUSIONS: The results from the current evaluation indicate that objective measurements utilizing digital photography are more sensitive at detecting differences than live subjective grading by trained observers. Their use as endpoints in clinical trials would lead to finer differentiation using smaller sample sizes than subjective rating with conventional scales.

92. **CENTRATION OF CONTACT LENS IN PERIPHERAL GAZE** (125069)

Nevin W. El-Nimri, Jeffrey Walline, OD, PhD, FAAO, The Ohio State University College of Optometry

RESULTS: The average ± SD age of the 40 subjects was 27.8 ± 8.4 years, 65% were female, 85% were white, and SE refractive error was -4.43 ± 2.05 D. The distance (mm) between limbus and CL edge in primary gaze while wearing habitual CL was: nasal (1.29 ± 0.30), temporal (1.26 ± 0.26), superior (1.77 ± 0.39) and inferior (1.49 ± 0.33). While looking in each gaze, the average distance from limbus to CL edge was significantly greater than primary gaze: nasal, 1.85 ± 0.33; temporal, 1.70 ± 0.36; superior, 1.96 ± 0.40; and inferior, 2.00 ± 0.43 (all $p<0.001$). The distance between the limbus and CL edge in primary gaze while wearing soft bifocal CL was: nasal (1.44 ± 0.26), temporal (1.54 ± 0.23), superior (1.90 ± 0.37) and inferior (1.92 ± 0.33). While looking in each gaze, the average distance from limbus to CL edge was significantly greater than primary gaze: nasal, 2.02 ± 0.26; temporal, 1.8 ± 0.30; superior, 2.14 ± 0.40; and inferior, 2.41 ± 0.40 (all $p<0.001$).
PURPOSE: Previous attempts to measure the bifocal effect with a soft bifocal contact lens (CL) during autorefraction have not been fruitful, and decentration of the CL may explain the problem. We aim to determine how much CLs move on the eye when looking in different gazes.
METHODS: The distance between the limbus and CL edge was measured with a reticle magnifier in the slit lamp ocular. The distance was measured at the superior, inferior, nasal, and temporal location of the CL while in primary gaze and while looking 20 degrees superior, inferior, nasal, and temporal (eg, when looking nasal, distance between temporal limbus and CL edge). All measurements were performed while subjects wore habitual CL and while they wore a Proclear Multifocal CL (power -2.50 to -3.00 with +2.00 add).
CONCLUSIONS: The subjects' habitual and soft bifocal CLs are decentered superiorly and temporally, respectively, in primary gaze. They move approximately 0.25 mm opposite to the direction of gaze when the eyes are turned. This could affect measurement of the CL bifocal effect if the subjects turn their eyes to measure peripheral refractive error.
ADDITIONAL COMMENTS: Supported by T35-EY007151

93. **SUBJECTIVE ACCEPTANCE OF SILICONE HYDROGEL VS. HYDROGEL - POPULATION STUDY** (125522)
Michel Guillon, FAAO, Cecile A. Maissa, PhD, London, UK

RESULTS: The results obtained showed that: i. The incidence of wearers classified as dry eye sufferers by the OSDI was similar for the two groups (SiHy 40% Hy 37%; $p=0.532$); ii. Comfort was similar with SiHy and Hy at all times of day ($p=0.340$ to 0.965), highest daytime (SiHy 73.8 Hy 73.7) and lowest in the evening (SiHy 56.5 Hy 58.2). Subjective vision demonstrated the same characteristics being similar at all times of day ($p=0.558$ to 0.909), highest during the day (SiHy 80.0 - Hy 78.6) and lowest in the evening (SiHy 67.2 – Hy 67.7); iii. Dryness symptomatology was similar at all times of day for SiHy and HY ($p=0.656$ to 0.838), lowest in the morning (SiHy 25.0 - Hy 27.4) and highest in the evening (SiHy 46.4 - Hy 45.4); iv. Diurnal variation was similarly marked for SiHy and Hy for all three parameters; v. The findings were independent of lens replacement frequency.

PURPOSE: The objective of the investigation was to evaluate the subjective acceptance (comfort, dryness and vision) and their diurnal variation in a population of daily wear silicone hydrogel (SiHy) and hydrogel (Hy) contact lens wearers who attended OTG R & C Clinic. The hypothesis tested was that the subjective acceptance was similar for the two types of contact lenses.
METHODS: The study population of 158 consecutive daily contact lens wearers: SiHy (60) & Hy (98) matched for Sex (p=0.728) but the Hy group was slightly older (SiHy 28 - Hy 32; p=0.013). The population symptomatology status was determined by the OSDI questionnaire. Subjective comfort and vision were evaluated on a 0 to 100 VAS scale (0= Very poor, 100= Excellent) and dryness on a 0 to 100 VAS scale (0 = Not dry at all, 100= Extremely dry) for three periods of the day, initial, daytime and evening.
CONCLUSIONS: Contact lens subjective acceptance and dryness symptomatology was similar for SiHy and Hy in a general population of contact lens wearers indicating that use of silicone component to achieve higher oxygen transmissibility has not resulted into improved subjective acceptance.

94. **THE ACCEPTANCE OF AND RESPONSES TO CONTACT LENSES IN SUBJECTS WITH DIABETES** (125904)

Elise Kramer, Rita Ganni, OD, Langis Michaud, OD, FAAO, University of Montreal School of Optometry

RESULTS: The lenses were worn for more hr/day in the diabetic group (12.0 vs 10.5; P<.05). Subjective comfort was similar in the 2 groups, although the diabetics reported a higher number of hours of wearing comfort (10.5 vs 8.5 hr/day; P<.05). Visual acuity did not change significantly in either group, and higher-order aberrations showed no significant differences between the two groups. Physiologically, the superficial punctate keratitis and hyperemia associated with lens use were mild and of similar degree in the two groups. Intraocular pressure, corneal hysteresis and corneal thickness did not vary significantly over time or between groups. Contact lens wear reduced TBUT in both groups to a similar degree. Similarly, the tear meniscus was significantly reduced for both groups. Finally, subjects in both groups reported good to very good subjective vision, except (as expected for the subjects' age) for intermediate and near vision.
PURPOSE: To compare the physiologic and subjective responses to contact lens wear between diabetics and controls.
METHODS: 12 diabetic (7 men, 5 women) and 15 nondiabetic (9 men, 6 women) subjects, were matched for age (41.5 +/- 2.4 vs 40.0 +/- 2.5 years, respectively) and oculo-visual characteristics (refraction, corneal and pupillary diameters and intraocular pressure). All 27 subjects were given daily-wear contact lenses in Comfilcon A with high oxygen permeability and followed for 2 months. The following measures were assessed before and after the wearing period: visual acuity, higher-order aberrations, corneal hysteresis, corneal thickness, inferior tear meniscus and tear break time (TBUT). A questionnaire was used to assess the subjective response to lens wear (vision quality, comfort). Data were analyzed using Student t-tests and ANOVA.
CONCLUSIONS: Diabetic and nondiabetic subjects had similar acceptance of contact lens wear, with no detectable adverse effects on vision or ocular health in either group. The routine avoidance of contact lenses in diabetics should be reconsidered.

95. **NET PROMOTER SCORE "HOW HAPPY PATIENTS CAN DRIVE REFERRALS IN YOUR PRACTICE"** (125259)
Cristina M. Schnider, OD, MBA, FAAO, Clay Gillam, Vistakon

RESULTS: Referral/recommendation were related to satisfaction with doctor, exam & glasses; provides comprehensive exam, treats me as valued customer, is an expert in their profession, follows up on next exam, & friendly helpful staff. With regard to the impact of CL satisfaction on recommendation, of 2539 CL wearers with a regular eye care practitioner, CL wearers who selected Very or Extremely Satisfied for their CL experience had an NPS of 70 (73% promoters, 3% detractors), whereas Satisfied to Dissatisfied wearers had an NPS of -61 (3% promoters, 64% detractors). For patients with astigmatism, NPS scores were lower than spherical wearers' overall, with NPS scores of 37 for CL wearers and 32 for non-wearers.
PURPOSE: To understand correlates of patient satisfaction and practice recommendation using the concept of NPS, or Net Promoter Score
METHODS: An online survey of 1000 non-CL wearers and 3000 soft contact lens wearers representing the census of the general US population for 18+ year old adults was conducted by an independent market research firm to assess attitudes and behaviors regarding vision care. Subanalyses were done according to the *0-10 Likely to recommend* score using the Net Promoter Score (NPS) concept to determine correlates of referral. NPS is the difference between % Promoters (9-10 rating for likely to recommend) and % Detractors (0-6 rating).
CONCLUSIONS: Providing a through vision exam and clearly communicating with the patient, as well as a friendly and helpful staff are related to the desire to recommend. For CL wearers, ensuring that they are well satisfied is critical to their propensity to recommend a doctor. It also appears there is a particular opportunity for improving the vision care experience with patients with astigmatism.

96. **EVALUATION OF CHANGES IN COMFORT AND VISION DURING WEEKS 3 AND 4 OF MONTHLY REPLACEMENT SILICONE HYDROGEL CONTACT LENSES** (125401)
Robert L. Davis, OD, FAAO, S. Barry Eiden, OD, FAAO, Deerfield, IL

RESULTS: No differences were noted in biomicroscopy scores between two weeks and one month. Ratings for comfort and vision parameters were evaluated for non-inferiority of the one month compared to the two week rating, using a margin of 0.50 on a 1-10 scale. Non-inferiority was established for ratings of visual clarity ($p=0.003$) and ocular redness ($p<0.001$). Agreement statements comparing comfort between the 2 week and 4 week visit were all found to be significant (all $p< 0.001$) and indicating that subjects did not notice change in comfort or vision over the time period tested.
PURPOSE: Lenses that are to be replaced on a monthly basis need to reasonably sustain performance through the entire wearing period. The purpose of this study was to examine changes in comfort and vision between 2 weeks and one month for wearers of lotrafilcon B lenses and assess if there is a significant drop in comfort in weeks 3 and 4.
METHODS: 115 current wearers of lotrafilcon B lenses each wore a new pair of lenses

for one month, on a daily wear basis using their habitual lens care system. Vision and comfort ratings, symptoms, and biomicroscopy scores were gathered at two weeks and one month. Subjects responded to agreement statements regarding any differences in perceived comfort or vision over the month of wear.
CONCLUSIONS: Comfort ratings showed a small decrease between two weeks and one month, however subjects expressed strong agreement with statements regarding consistency of both comfort and vision throughout the month of wear. Wearers of lotrafilcon B lenses do not perceive substantial drops in comfort or vision over the recommended wearing interval. The small decrease in comfort supports compliance with a monthly replacement of these lenses.
ADDITIONAL COMMENTS: This investigation was supported by a grant from Alcon/Ciba

97. **RETROSPECTIVE ANALYSIS OF DIFFERENCES IN PHYSIOLOGICAL RESPONSE AND CLINICAL PERFORMANCE OF LENSES BETWEEN ASIAN AND CAUCASIAN CONTACT LENSES WEARERS** (125502)
Jerome Ozkan, BOptom, Percy Lazon de la Jara, BOptom, PhD, FAAO, Thomas Naduvilath, MSc, PhD, Brien A. Holden, PhD, DSc, FAAO, Brien Holden Vision Institute
RESULTS: Asian subjects had tighter lens fit (47.1 Â± 4.7 vs 45.6 Â± 4.0, p = 0.001) and showed a significant inferior lens decentration (-0.02 Â± 0.12 vs 0.03 Â± 0.13, p=0.001). Asian subjects also reported better initial comfort (8.5 Â± 1.5 vs 8.0 Â± 1.8, p = 0.002), less symptoms of lens awareness (8.2% vs 12.2%, p = 0.022). Asians wore lenses for a shorter period of time (10.2 hours Â± 2.8 vs 11.9 hours Â± 2.6, p < 0.001) and reported shorter comfortable wear time (8.6 hours Â± 3.2 vs 10.1 hours Â± 3.2, p < 0.001). The incidence of significant corneal inflammatory events was lower in Asian subjects, even after adjusting for lens tightness and centration (1.6% vs 4.9%, p = 0.04, odds ratio: 0.27, 95% CI: 0.08 to 0.94).
PURPOSE: Anatomical and physiological differences between Asian and Caucasian ethnicities can influence contact lens performance and lens acceptance. The aim of this study was to determine what differences exist between Asian and Caucasian contact lens wearers in terms of physiological response and clinical performance of lenses.
METHODS: A retrospective analysis was conducted on 638 subjects (193 Asian and 445 Caucasian) with an age range between 20 and 40 years (36% male & 64% female) who had participated in clinical trials between 2004 and 2009. Evaluation of lens fitting performance, subjective responses and physiological measures (redness and staining) was assessed across ten commercial lenses and five lens care systems and compared between ethnic groups using linear mixed model after adjusting for contact lens and solution effect. Ocular adverse events rates were analysed using logistic regression.
CONCLUSIONS: Ethnicity influences contact lens performance and may play a role in the incidence of significant corneal inflammatory events. This factor needs to be considered by practitioners and manufacturers to achieve a more successful fitting outcome.

98. **AFM AND SEM ANALYSIS OF LIMBAL RING CONTACT LENSES** (125610)

Kathrine Osborn Lorenz, FAAO, David Pinto, Joseph Kakkassery, PhD, Johnson & Johnson Vision Care

RESULTS: SEM cross-section images at 500x and 2,000x magnification showed pigment on the surface of 5 of the 6 lens types tested. The mean depth of pigment for 1-DAY ACUVUE DEFINE (1DAD) (JJVCI) lenses was 8.1 um below the front surface of the lens, while the remaining lens types tested had pigment particles on the front surface or back surface of the lens. Results of AFM analysis indicated that 1DAD lenses had lower RMS roughness and Peak-to-Peak (PtP) values than the other lens types tested (1DAD RMS roughness pigmented area mean = 8 um vs 30-67 um) (1DAD PtP pigmented area mean= 79 um vs 285-669 um). Also, no significant difference was found between the pigmented and non-pigmented areas for RMS roughness or PtP roughness for 1DAD lenses (pigmented area mean RMS = 8(2) um/PtP = 79(30), non-pigmented mean RMS = 6(2) um/PtP = 62(24)), further supporting the pigment being enclosed within the lens matrix.
PURPOSE: Limbal Ring (also known as circle-tinted) contact lenses have received negative press in the past few years, and even led to an AAO/AOA joint statement regarding prescribing practices. All limbal ring lenses, however, are not the same. The pigment particles can be found on the front or back surface of the contact lens or enclosed within the lens matrix, which may lead to differences in on-eye performance. The purpose of this study was to evaluate the pigment location and surface roughness of circle contact lenses from six manufacturers.
METHODS: Scanning Electron Microscopy (SEM) was completed by an ISO-certified laboratory to discern the placement of pigment, whether on top of or enclosed within the contact lens material, to a sub-micron level. Atomic Force Microscopy (AFM) was used to measure the surface roughness of both pigmented and non-pigmented regions of the front surface and back surface of the contact lenses.
CONCLUSIONS: SEM and AFM testing revealed pigment on the surface of the lens for all types tested with the exception of 1DAD. Further research is required to determine if the difference in pigment location influences on-eye performance.

99. **CONTACT LENS PRESCRIBING PATTERN IN INDIA - 2011** (125183)
Nilesh Thite, BOptom, M Optom, Bharati Vidyapeeth Deemed University Medical College School of Optometry

RESULTS: Responses from two hundred and twenty seven practitioners with details of 2270 contact lens fits were received. The mean age of patient group was 27 (67% females). 40% of the total fits were new fits. 98% of the total patients wore soft contact lenses. 65% of them wore monthly disposable lenses. Conventional lenses were fitted more ($p<0.001$) in non-metro cities compared to metros. Among soft lens fits, torics and presbyopic (bifocal/multifocal) fits contributed 24% and 2% respectively. 28% of the lens users were dispensed silicone hydrogel lenses. Females wore cosmetic lenses significantly higher ($p<0.001$) than males. Eye care practices based on retail optical chains dispensed more disposable lenses ($p<0.001$) as well as silicone hydrogels ($p<0.001$). Among RGP lenses, high Dk material (49%) was prescribed the most and no ortho-k fits were reported. Logistic regression analysis showed longer years of experience

(OR:3.51,95% CI:1.27 to 9.67) and a FIACLE status (OR:13.79, 95% CI:2.61 to72.70) were directly associated with fitting of advanced design contact lenses.
PURPOSE: To understand the pattern of prescribing contact lenses among Indian practitioners
METHODS: Surveys were sent to contact lens practitioners to collect information about their qualification, type and location of practice, years of experience and the details of their last 10 contact lens fits.. A logistic regression analysis was performed to find out the association of various factors to the lens fitting trends and chi-square test was used to compare proportions. The data was analyzed using SPSS v.16.
CONCLUSIONS: Soft lenses heavily dominate Indian contact lens market with silicone hydrogel material clearly emerging as the future material of choice. Disposable lenses are well established and contributed to 90% of total fits. Higher level of lens fitting experience and having an FIACLE status were seen to be significantly associated with advanced fitting trends.
ADDITIONAL COMMENTS: Co-authors - Babu Noushad & Gauri Kunjeer

100. **ORIENTATIONAL PERFORMANCE OF TWO DAILY DISPOSABLE TORIC SOFT LENS DESIGNS** (125657)
Lee A. Hall, BSc, MCOptom, Visioncare Research Ltd, Kathrine Osborn Lorenz, OD, MS, FAAO, Youssef Toubouti, MS, Johnson & Johnson Vision Care, Graeme Young, MPhil, PhD, FAAO, Visioncare Research Ltd

RESULTS: The ASD lens showed significantly less absolute rotation (i.e. orientation closer to the zero position) at both 1 minute (6.7^o vs. 12.7^o, P=0.0012) and 3 minutes (6.3^o vs. 13.0^o, P=0.0001) after insertion. However, there was no significant difference in absolute orientation between the two designs at the 20 minute assessment (5.4^o vs. 6.8^o, P=0.43).
PURPOSE: To compare the clinical performance of two daily disposable toric soft contact lens designs with respect to orientation after random insertion.
METHODS: This was a 40 subject, one-visit, single-masked (subject), randomized, bilateral cross-over study comparing two lenses utilizing different methods of stabilization; an 'accelerated stabilized design' (ASD), *1-Day* ACUVUE MOIST for ASTIGMATISM (Johnson & Johnson Vision Care, Inc.) and a 'dual thin' design (DTD), Focus Dailies Toric All Day Comfort (Alcon Vision Care). Lenses were inserted at random orientation and evaluated using a slit lamp with an eyepiece protractor, 1, 3 and 20 minutes after insertion. The video images were then analyzed frame by frame to determine the time to reach final orientation settling position. Absolute rotation was analyzed using a linear mixed model for repeated measures on log-transformed data. All statistical tests were two-sided with type I error rate controlled at 5%.
CONCLUSIONS: Significant differences were noted in clinical performance between the two designs, with the ASD showing significantly less misorientation than the DTD 1-minute and 3-minutes after insertion.

101. **ENHANCING THE PRESBYOPIC PATIENTS CONTACT LENS WEARING EXPERIENCE THROUGH A UNIQUE LENS DESIGN** (125476)

William T Reindel, OD, MS, Jagannath Ghosh, PhD, Siva Raj, MA, MBA,
Bausch+Lomb Inc.

RESULTS: A total of 119 subjects completed the study. LogMAR VA for distance, intermediate, and near were not significantly different; however, vision ratings based on experience were significantly greater for PV2MF for all three distances, $p<0.05$. Ratings of vision were significantly higher for PV2MF during various situations including: Vision in bright light, low light, at night, when reading, when driving at night, when watching TV, when looking at computer, and when looking at mobile device, $p<0.05$. Comfort ratings at insertion and at the end of the day also favored PV2MF, $p<0.05$. Ease of changing from distance to near was preferred 2X more often and overall preference was preferred 3X more often for PV2MF, $p<0.05$.
PURPOSE: : In a world with growing use of computers and digital devices, the visual demands on presbyopic patients also increases. A unique contact lens design was developed to improve intermediate and near vision experiences. The purpose of this study was to compare the patient experiences with a novel balafilcon-A multifocal design (PV2MF) compared to an established design (PVMF).
METHODS: A randomized, bilateral, 2-week crossover, double-masked, study was conducted at 6 sites. Presbyopic contact lens wearers that required a near add correction from +1.50 to +2.50 D. were enrolled. LogMAR VA, vision, comfort and wear experience ratings were obtained.
CONCLUSIONS: As vision demands on the presbyopic patients increase, new lens design technologies are needed to meet these demands. The unique optical design and thin geometry of PV2MF resulted in subjects having a better vision experience with PV2MF when compared to the established PVMF lens. These enhanced wearing experiences may not be apparent by measured VA in office. The PV2MF design also offered a more comfortable wearing experience.

102. **QUALITY OF LIFE COMPARISON IN TEENAGERS WEARING CONTACT LENSES OR SPECTACLES - INTERIM RESULTS OF A SIX-MONTH STUDY** (125101)

Andrew J. Plowright, MSc, Eurolens Research The University of Manchester, Timothy A. Giles, Alcon Research Ltd, Carole Maldonado-Codina, BSc (Hons), MSc, PhD, MCOptom, FAAO, FBCLA, Eurolens Research The University of Manchester, Philip B. Morgan, BSc(Hons), PhD, MCOptom, FAAO, FBCLA, Eurolens Research The University of Manchester

RESULTS: PREP results at baseline showed no differences between the groups. At four weeks, statistically significant differences were seen in favour of contact lenses for 'appearance' ($p<0.0001$), 'satisfaction' ($p<0.0001$), 'activities' ($p<0.0001$), and overall PREP score ($p<0.001$). QIRC scores at both baseline and four weeks were similar for the two groups. SMS data collected for the first 10 weeks of the study showed no difference between the two groups for 'happiness' ($p=0.60$). For SMS 'vision', there was a statistically significant increase in scores over time for the contact lens group ($p = 0.002$).
PURPOSE: To compare quality of life data from teenagers dispensed with either contact lenses or spectacles using Pediatric Refractive Error Profile (PREP) and Quality of Life

Impact of Refractive Correction (QIRC) questionnaires, and SMS (text message) data collection.
METHODS: One hundred and ten subjects aged between 13 and 19 years, with no history of lens wear were randomised to wear either DAILIES AquaComfort Plus (Alcon Inc.) or new spectacles for six months. At baseline, 1 month, 3 month, and 6 month clinical visits, subjects underwent a full clinical workup and completed both PREP and QIRC questionnaires. In addition, scores for subjective vision and 'happiness' were collected once per week using automated SMS messaging.
CONCLUSIONS: Overall, young subjects appear satisfied with both spectacles and contact lenses as forms of vision correction. There was evidence for improvement in subjective vision over the first 10 weeks of wear in the contact lens group. Some subjective scores were similar for the two groups, whereas other aspects ('appearance', 'satisfaction' and 'activities') demonstrated superior performance in favour of contact lenses. As these aspects of life are particularly important to young people, we conclude that contact lenses are an excellent option for refractive correction in teenagers with no previous contact lens wearing experience.
ADDITIONAL COMMENTS: This work was sponsored by Alcon, Inc.

103. **OVERNIGHT LENS WEARING HABITS OF STUDENTS WHO HAVE AND HAVE NOT RECEIVED FORMAL DIDACTIC CONTACT LENS EDUCATION AT THE ILLINOIS COLLEGE OF OPTOMETRY** (125115)
Elyse L. Chaglasian, OD, FAAO, Hoang Harry Tran, Illinois College of Optometry

RESULTS: A total of 67 students participated in the survey. Group A contained 31 students and Group B contained 36 students. Approximately 22.6% (n=7) students in Group A were considered non-compliant contact lens wearers, which was similar to the non-compliance rate of 25% (n=9) in Group B. In Group A, 3.2% (n=1) of the students did not know whether or not their contacts were approved for extended or overnight wear, which was again similar to what was found in Group B, 0% (n=0).
PURPOSE: The primary goal is to investigate and compare the overnight contact lens wearing habits between individuals who have and have not received formal education on contact lens wear in their didactic program at the Illinois College of Optometry. The secondary goal is to observe if there is any correlation between an individual's improved education regarding contacts and being aware if their contacts are approved for extended wear.
METHODS: The four classes at the Illinois College of Optometry were separated into two population groups. The first group (Group A) was comprised of the graduating classes of 2015 (1st year) and 2014 (2nd year). The extent of contact lens knowledge for this group was assumed to be similar to most contact lens patients; that is, from friends, family, media and education from their contact lens practitioner. The second group (Group B) was comprised of the graduating classes of 2013 (3rd year) and 2012 (4th year) who had taken at least one required contact lens course at the Illinois College of Optometry. Data was collected on the two groups' contact lens wearing habits via a Zoomerang survey.
CONCLUSIONS: Statistical analysis demonstrates that formal didactic education concerning the potential negative consequences of extended wear with soft contact lenses

does not translate into greater compliance in an optometric student population. Secondarily, both student groups were equally likely to know if their lenses were approved for extended use.

104. **THE ELEVATION MAP BEST FIT SPHERE AS STARTING POINT FOR GAS PERMEABLE CONTACT LENS FITTING** (125130)

Cirous Dehghani, MSc, PhD, School of Optometry Queensland University of Technology, Shahram Bamdad, Zahra Tajbakhsh, Department of Ophthalmology, Shiraz University of Medical Sciences

RESULTS: The mean age of the subjects was 23.5 ± 5.2 years. 79 % of eyes were keratoconic, 12.5 % had regular astigmatism, and 5.6 % were pos-LASIK or post-PK. During the 3-month follow-up only one advanced keratoconic eye developed superficial corneal staining. Prior to GP lenses, the mean of best spectacle corrected VA, spherical equivalent refraction and subjective cylinder were 2.7 LogMar, -5.70 D and -3.12 D, respectively. Over contact lens refraction showed that the mean of residual astigmatism and GP corrected VA was -0.80 D and 1.10 LogMar, respectively. Regression analysis revealed that both BFS and flattest corneal curvature had a significant association with final GP base curve ($p<0.0001$). The difference between mean final base curve and mean BFS was 0.14 mm. At the last visit 58 % of participants reported that their daily wearing time was more than 8 hours.

PURPOSE: To assess the clinical utility of the corneal elevation BFS as starting point for conventional GP lens fitting

METHODS: A total of 72 eyes with different indications for GP lenses including keratoconus, regular astigmatism, post-PK and pos-LASIK were enrolled. Prior to GP lens fitting, all participants underwent a complete eye examination. In addition, an elevation topography map was captured using Pentacam HR or Orbscan IIz. The initial trial GP base curve was selected based on anterior BFS on the elevation maps. Fluorescein pattern, lens movement and centration were evaluated and base curves were changed until an optimal fitting was achieved. Over contact lens refraction was performed, best GP visual acuity was determined and GP lenses ordered. 3 scheduled visits for each participant were conducted. At each follow-up visit, slit lamp examination, fluorescein pattern and visual acuity were recorded.

CONCLUSIONS: Finding a corneal parameter that facilitates the fitting process is very important for reducing chair-time and using small number of diagnostic trial lenses. The findings of this study suggest that BFS may be useful in selecting an initial diagnostic lens for GP fitting

105. **IRREGULAR CORNEAS AND THE REVITALEYES POST-SURGICAL LENS: A CASE SERIES** (125739)

Jennifer S. Harthan, OD, FAAO, Illinois College of Optometry

BACKGROUND: Post-surgical contact lens fits can be difficult secondary to corneal irregularity and limited lens modalities available. Small or large diameter GP lenses are often required to correct the irregularity and provide stable vision. Custom soft lenses have played a limited role for these corneas due to limited parameters, materials, and lack

of oxygen transmission. Today, there are more contact lens options available to optimize vision and comfort. Described here are 3 patients with irregular corneas secondary to surgical procedures that failed with other lens modalities and were successfully fit with the RevitalEyes custom soft lenses made in the Definitive material.
CASE REPORT(S): A 46 y/o CF presented with decreased vision and ghosting s/p LASIK OD two years prior. A refraction of -0.25-0.75x180 improved vision to 20/25. Previous GP and soft lenses were uncomfortable and unstable. Clear, comfortable vision was achieved with the 8.7 lens. A 56 y/o AM s/p PKP OD secondary to an ocular infection presented wanting new spectacles. Previous contact lens intolerance caused hesitation towards new lenses. Image distortion was evident with a refraction of +0.50-5.25x080, 20/50OD and +1.75-1.50x110, 20/20OS. The 7.8 lens improved vision to 20/25OD while increasing comfort and image quality. A 16 y/o CM presented for a contact lens fit OS following a full thickness penetrating corneal accident in chemistry. With a refraction of +4.25-6.00x077, vision was 20/30. Vision improved to 20/25 with the 8.1 lens. Several lenses were re-ordered secondary to changing astigmatism after suture removal. He is now able to wear the lens comfortably daily for twelve hours.
CONCLUSIONS: The RevitalEyes post-surgical reverse geometry custom soft lens in the Definitive material can be made to order in a variety of base curves and diameters to offer post-surgical patients good vision and comfort while maintaining optimal corneal health. Depending on the surgical procedure, it may be necessary to start with a base curve slightly different than the recommended fitting guide to provide lens stability.

106. **CREATING PROSTHETIC CONTACT LENSES - USING YOUR IMAGINATION,** (125608)
Sunny M. Sanders, OD, FAAO, Midwestern University, Arizona College of Optometry

BACKGROUND: Tinted contact lenses are used for a number of patient care scenarios, from cosmetic eye color enhancement to therapeutic prosthetic and functional creations. This case presents the use of a cosmetic opaque colored contact lens that was modified using an in-office soft lens tinting process to create a cost effective custom tinted prosthetic contact lens to eliminate severe photophobia for a patient with Calcific Band Keratopathy.
CASE REPORT(S): Calcific Band Keratopathy degeneration affects Bowman's layer with calcium hydroxyapatite deposits that coalesce to form a band in the interpalpebral zone. This 12 year old congenital cataract patient underwent cataract surgery at age 1 and the resultant severe calcific band keratopathy requires periodic debridement. Debilitating photophobia has been a constant issue. The patient was originally fit with a cosmetic opaque colored contact lens having a clear pupil and a brown iris print. Light could easily penetrate the pupil opening and between the iris pattern. The calcification was visually evident to any observer. The patient complained of severe photophobia. The patient's base eye color was matched and an iris mask tint with black pupil were added the back side of the opaque lens design providing light protection and enhanced cosmesis. The patient was able to function in any light condition without discomfort. The disposable lens modality provided a healthier and economical alternative to annual hand-painted prosthetic contact lenses.
CONCLUSIONS: The process of in-house lens tinting allows the creation of unique

therapeutic contact lenses almost immediately. Color creation and modification of color and intensity can be done while the patient is in the exam chair. This case demonstrates the potential of improving patient quality of life. Use of lens tints specific to the patient condition will likely benefit many individuals with unusual visual needs. This case presents the practitioner with out of the box thinking in regards to meeting the patient's special needs and can be incorporated in any manner of practice.

107. **REVERSE PIGGYBACK CONTACT LENS COMBINATION FOR PHTHISIS** (125005)

Rutvi Doshi, PhD, New England College of Optometry, Lynette K. Johns, OD, FAAO, Boston Foundation for Sight, Ronald K. Watanabe, OD, FAAO, New England College of Optometry

BACKGROUND: We report a case of a pre-phthisical eye that underwent multiple surgeries for a childhood penetrating injury. The patient was referred for prosthetic replacement of the ocular surface ecosystem (PROSE) treatment for visual rehabilitation of irregular astigmatism. In conjunction with the custom PROSE device, a reverse piggyback painted soft lens was designed for a limited wear schedule to improve cosmesis.
CASE REPORT(S): A 39 year old Caucasian female sustained trauma to her left eye at age 15. She underwent three retinal detachment surgeries, a penetrating keratoplasty, and a posterior chamber intraocular lens replacement. The eye became pre-phthisical after an episode of hypotony. The patient attempted a trial with a prosthetic shell, but was uncomfortable and unable to adapt due to loss peripheral vision. Her entering BCVA was 20/15 OD and 20/400 OS. With PROSE treatment, the left eye was rehabilitated to 20/70. The lid aperture was purposely widened for improved cosmetic symmetry with the highly customized PROSE device. She is able to wear the device comfortably for up to 6 hours without any ocular surface or graft compromise. Due to traumatic and surgical aniridia, we explored other contact lens cosmetic options. Since painted scleral lenses are currently made with PMMA, they not a viable option for this patient due to risk of graft hypoxia. Consequently, the left eye was then fit with a painted iris soft prosthetic lens over a PROSE device. Two hours of wear time was suggested for this novel reverse piggyback solution to protect the graft from hypoxia.
CONCLUSIONS: The combination of a cosmetic contact lens over a PROSE device can provide significant improvement in comfort, vision, and cosmetic appearance without severely compromising the health of the cornea. This reverse piggyback combination is a consideration when treating phthsis and traumatic aniridia.

108. **BALANCING TREATMENTS OF AN IRREGULAR CORNEA AND APHAKIA FOLLOWING RUPTURED GLOBE REPAIR: A PEDIATRIC CASE SERIES** (125969)

Andrew D. L. McLeod, OD, MS, FAAO, Boston University School of Medicine, Yin-Yin Aung, BA, OD, New England College of Optometry

BACKGROUND: Contact lenses are often used for the treatment of aphakia after cataract extraction to restore vision and prevent amblyopia. Children who suffer from

injuries that rupture the globe can also be left aphakic. Treating these patients is more challenging when the aphakia is combined with corneal scarring, irregular irises, or conjunctival scarring. This case series follows three patients though different treatment plans that address multiple ocular injuries.
CASE REPORT(S): Patient one is 4-year old Hispanic male who suffered a dog scratch that left him aphakic with a large central corneal scar and damaged iris. Uncorrected visual acuity was hand-motion and improved to 20/60 with an altered bitoric gas permeable lens. Patient care was complicated by parental compliance with patching therapy and sustainable vision through the central scar. Atropine dilation was attempted to allow visibility around the scarring. Patient two is a 12-year old Caucasian male who sustained a penetrating injury with a pen that left him aphakic, with an irregular iris, and corneal scarring. Uncorrected visual acuity was counting fingers at one foot. This patient corrected well on subjective refraction so a spherical soft contact lens was fitted with 20/25 distance acuity, but 20/200 near acuity. In addition, multifocal soft contact lenses were attempted to improve both distance and near vision to 20/30 and 20/40 respectively. Patient three is an 8-year old African American male who suffered a projectile injury from a rock, leaving him with counting fingers vision in the affected eye. Due to elevated corneal scarring and peripheral suturing a hybrid contact lens was pursued to give 20/60 acuity.
CONCLUSIONS: Ruptured globe repair can leave patients with multiple injuries. Newer lens modalities and advanced parameter availability allow for innovative treatments that were not previously available. A collaborative effort between multiple providers, the patient, and their parents is necessary for successful outcomes.

109. **PIGGYBACK SYNERGEYES KC: SILICONE HYDROGEL LENS CORNEAL MODIFICATION LEADING TO SUCCESSFUL SYNERGEYES KC FITTING** (125001)

Jennifer Q. Duan, OD, FAAO, Arkady Selenow, OD, Institute for Vision Research

BACKGROUND: Piggyback contact lens fitting has been utilized to alleviate lens discomfort and to reduce corneal disturbance for keratoconic patients. Historically, this method utilizes a gas permeable (GP) lens fit on top of a soft lens. Since the introduction of SynergEyes KC lenses in 2006, it is becoming more prevalent for clinicians to utilize this hybrid design lens, with a gas permeable center and soft lens skirt. The design provides the optics of a gas permeable lens with the comfort of a soft lens.
CASE REPORT(S): A 24 year old white male presents with a chief complaint of lens intolerance in the right eye with SynergEyes KC lens wear. Patient has advanced keratoconus OU; SimK findings were 68.46@52/64.66@142 OD; 67.37@007/60.59@97 OS. His best-corrected visual acuities were 20/200 OD; 20/400 OS. Due to significant corneal scarring in the left eye, the patient only wore a lens in the right eye. Historically, GP lens fitting was unsuccessful due to lens instability and poor patient comfort. We refit the patient into a SynergEyes KC contact lens with mild success. Over time, the patient's maximum wearing time decreased to 3 hours per day with unacceptable corneal bearing and poor lens movement even with an ideal SynergEyes KC lens. Biomicroscopy revealed central corneal abrasion in the right eye. To achieve an acceptable lens fit, we utilized a silicone hydrogel base lens to modify the central corneal curvature,

progressively flattening the anterior surface by increasing the power of the soft lens. This created the flatter anterior surface needed to optimize the SynergEyes KC fit. The optimal fit was achieved with a -5.00sph silicone hydrogel base lens and -7.50sph, 6.5mm base curve, 7.9mm peripheral curve SynergEyes KC lens. The patient's best-corrected visual acuity with this combination was 20/30. Lens movement was acceptable and patient wear time increased to 12 hours daily.
CONCLUSIONS: In advanced keratoconic cases, silicone hydrogel lenses can be combined with SynergEyes KC lenses to improve comfort, fit and epithelial integrity.

110. **MANAGEMENT OF KERATOCONUS PRE AND POST COLLAGEN CROSSLINKING (CXL) WITH POST CXL MICROBIAL KERATITIS** (125102)
Peggy S. Achenbach, OD, FAAO, Martin Conway, FBDO, Contamac LTD

BACKGROUND: Case a unique opportunity to analyze and fit keratoconic pre- and post-collagen crosslinking (CXL). Patient diagnosed with keratoconus at age 13, initially fit with Kerasoft, keratoconus progressing at an alarming rate. At age 17 she was wearing Clearkone contact lenses OU with decreased VA, discomfort and decreased wear time. Patient unable to drive or attend college due to poor vision. CXL recommended but patient was unable to afford procedure.
CASE REPORT(S): A 17 yo female diagnosed with bilateral keratoconus at age 13 presented with discomfort, decreased vision and decreased wear time resulting in discontinuation of current contact lenses. General health was unremarkable and biomicroscopy revealed 2+ corneal staining. She was told this was a contact lens solution incompatibility. Further investigation revealed the staining was due to CL overwear. Patient was successfully re-fit with the KeraKone corneal gas permeable contact lenses. for both eyes. CXL was performed OS and the patient developed microbial keratitis post CXL. This sequelae to CXL was first reported in 2009 (J Cataract Refract Surg 2009; 35:1138-1140). This is a rare side effect of CXL and added increased complexity to this challenging case. The Kerakone lens was then fit OS post CXL. The patient has been advised to have CXL done on the right eye. The fitting and follow up is ongoing. All pre- and post- CXL corneal topographies, refractive assessments, contact lens fits and corneal health evaluations are presented.
CONCLUSIONS: Pre-CXL, the patient was successfully re-fit with KeraKone contact lenses after having been fit with a number of keratoconic lenses including an early generation of Kerasoft and ClearKone. Post CXL on the left eye resulted in a rare microbial keratitis and a refit into the KeraKone lens. CXL on the right eye is pending and the fitting and follow up is ongoing. This case presentation demonstrates that multiple therapies and lens designs may be required to treat complicated, advanced keratoconics. The many contact lens designs and materials available today make this possible.

111. **EFFECTS OF OPTI-FREE® PUREMOIST® MPDS ON THE HYDROPHOBIC DOMAINS OF SILICONE HYDROGEL CONTACT LENSES** (125396)
Jessie Lemp, MSc, Alcon Research Ltd, Leaann Love, Jean T. Jacob, PhD, Louisiana State University Health Sciences Center, Jami R. Kern, PhD, Alcon Research Ltd

RESULTS: Sudan IV sorption into all four lens types was significantly reduced as compared to control lenses by OFPM. The extent of blocking was dependent on the lens type and the time of exposure. In general, OFPM reduced the hydrophobic domains (AirOptix Aqua>Biofinity> Acuvue Oasys, PureVision 2) available for staining. Longer periods of exposure to the Sudan IV indicated that OFPM blocked the bulk hydrophobic domains by over 66% for all the tested lens types.
PURPOSE: To determine the extent Opti-Free® PureMoist® (OFMP), a multipurpose disinfecting solution (MPDS) containing a novel diblock copolymer of poly (oxyethylene)-poly(oxybutylene), decreases silicone hydrogel (SiHy) lens hydrophobicity by reducing the hydrophobic domains on contact lens surfaces and within their bulk when used before and after simulated wear conditions.
METHODS: Four brands of silicone hydrogel lenses (Acuvue®Oasys®, PureVision® 2, Air Optix® Aqua and Biofinity®) were exposed to artificial tear fluid (ATF) before and after soaking in OFPM. Hydrophobic domain staining was determined using a saturated solution of Sudan IV. The extent of Sudan IV dye (dispersed in silicone oil) staining and adsorption over time was used to gauge the surface (30 minute exposure time) and bulk (16 hour exposure time) effects of OFPM on the hydrophobic domains of the SiHy lenses. Staining was documented by photography and total amount of dye adsorbed quantified after dye extraction.
CONCLUSIONS: Opti-Free PureMoist MPDS significantly decreased the binding of Sudan IV to both surface and bulk hydrophobic domains in all lens types tested, particularly Air Optix Aqua. This effect is believed to be important in the wettability, lubrication, and lipid adsorption prevention properties of the novel block copolymer within Opti-Free PureMoist MPDS.

112. **BIOCOMPATIBILITY OF A NOVEL HYDROGEN PEROXIDE LENS CARE SOLUTION WITH HUMAN CORNEAL EPITHELIAL CELLS** (125922)
Karl R. VanDerMeid, BS, Karen L. Harrington, BS, Kimberly A. Millard, MS, Suzanne F. Groemminger, AAS, Jin-Zhong Zhang, PhD, Megan Cavet, Bausch+Lomb Inc.

RESULTS: Peroxide concentrations in the range of 30-300 ppm had equivalent minimal effects on HCEpiC viability. Residual H2O2 levels in the lens care systems were 4853 ppm for the novel solution and 20-650 ppm for the marketed products after 1 h. After 4 h all solutions were below 100 ppm. HCEpiC viability after 15 min exposure to the 1 h neutralized novel and marketed one-step solutions, and all-in-one solution was significantly lower than control, while remaining solutions were without effect. HCEpiC monolayer resistance significantly decreased after 2 h exposure to the 1 h neutralized novel and marketed one-step H2O2 solutions, while after 4 h neutralization there was no effect. There was no significant difference between cases cycled 1 or 35 times on residual H2O2 levels in the novel solution or its effect on HCEpiC viability.
PURPOSE: To evaluate the effects of a neutralized novel one-step 3% hydrogen peroxide (H2O2) disinfecting lens care system as compared to marketed peroxide products on human corneal epithelial cell (HCEpiC) viability and barrier function.
METHODS: HCEpiC were exposed to 1-300 ppm peroxide or a novel and marketed H2O2 lens care solutions (1 or 4 h neutralized one-step or two-step and all-in-one),

HBSS was the control. HCEpiC viability was assessed using an alamarBlue assay and barrier function was determined using electrical cell-substrate impedance sensing. Effect of lens case cycling on residual peroxide and HCEpiC viability was also determined for the novel solution.
CONCLUSIONS: There was a delay in neutralization of the novel lens care solution at 1 h, whereas H2O2 levels were comparable to marketed products at 4 h. After 1 h neutralization, there were significant effects of the majority of H2O2 lens care solutions on HCEpiC viability and barrier function, while after 4 h, the effects of all solutions on these parameters were minimal.

113. **TEAR CYTOKINE RESPONSE TO MULTIPURPOSE CONTACT LENS SOLUTIONS** (125110)

Carolyn M. Kalsow, PhD, Ocular Research Services, William Reindel, OD, MS, Mohinder Merchea, OD, PhD, FAAO, Kirk Bateman, MS, Joseph Barr, OD, MS, FAAO, Bausch+Lomb Inc.

RESULTS: Longitudinal analysis revealed similar patterns of response for several proinflammatory cytokines: subjects who received OF in Phase 1 had values that were generally higher than those of the RN Phase 1 group throughout both phases. Subjects using OF in Phase 1 had statistically significant ($p<0.01$) increases over baseline at Day 1 and/or at washout for 13 proinflammatory cytokines (CCL-3, CCL-5, CCL-11, GM-CSF, IFN-gamma, IL-2, IL-4, IL-5, IL-6, IL-13, IL-15, IL-17, TNF-alpha). This increase at day 1 and failure to return to baseline at washout were not seen with subjects who used RN in Phase 1. Phase 1 OF subjects also had increased dryness during the daily period of wear, and RN Phase 1 subjects had a decrease in bulbar hyperemia and an increase in ocular surface fluorescence. There were no changes detected for limbal hyperemia or surface sensitivity thresholds.
PURPOSE: An increased risk of corneal infiltrative events (CIE) has been noted with the use of contact lenses (CL) and multipurpose solutions (MPS). Tear cytokine levels were measured to assess the ocular surface response to CL/MPS. Results were evaluated in the context of other ocular surface tests to clarify associations with CIE formation and to evaluate clinical relevance of these tests of CL/MPS effect.
METHODS: Two MPS: OptiFree RepleniSH, Alcon (OF) and renu fresh, Bausch+Lomb (RN) were used with daily wear PureVision lenses (Bausch+Lomb) in a randomized, prospective crossover study involving 26 subjects. Clinical data collection (conjunctival hyperemia, pneumatic mechanical and chemical thresholds, corneal fluorescence, and subjective responses) and tear cytokine assays (Bio-Plex Human Cytokine 27-Plex Assay on a Luminex 200 platform) were conducted masked by independent study centers. Responses were tracked as change from baseline throughout the entire experimental schedule.
CONCLUSIONS: Cytokine levels, symptom and hyperemia scores suggest a proinflammatory response to OF compared to RN. Tear cytokine profiles may be useful in reconciling clinical relevance of test results and in revealing mechanisms of CIE.

114. **EFFICACY OF MULTI-PURPOSE SOLUTIONS AGAINST GRAM NEGATIVE CLINICAL ISOLATES ASSOCIATED WITH INFILTRATIVE KERATITIS** (125376)

Mohinder M. Merchea, OD, PhD, FAAO, Brien David, Denise Callahan, Julie Blair, Bausch+Lomb Inc.

RESULTS: Biocidal efficacy testing with organic soil demonstrated log unit reductions of 3.5, 4.6, and 2.9 against S. maltophilia D. acidovirans, and A. xylosidans, respectively, for the test MPS (PHMB-PQ). Each control (PQ-MAPD combination) MPS (OptiFree Express, RepleniSH and PureMoist) demonstrated log unit reductions against A. xylosidans of 0.2, 0.0 and 0.1; for S. maltophilia of 1.2, 1.3 and 1.2, and for D. acidovirans of 3.0, 1.4, and 2.9 respectively.

PURPOSE: Contact lens associated infiltrative keratitis (CLAIK) is associated with several factors including lens case bioburden. Previous work identified case contamination of CLAIK patients with particular gram-negative clinical isolates, the predominant species being Stenotrophomonas maltophilia, Delftia acidovirans, and Achromobacter xylosidans. This study evaluated the efficacy of different multi-purpose solutions (MPS) against these clinical isolates.

METHODS: MPS used in this study contained the preservative agents: polyhexamethylene biguanide (PHMB), polyquaterium-1 (PQ) and/or myristamidopropyl diethylamine (MAPD). A test MPS based on PHMB-PQ (Biotrue) and 3 different control MPS based on PQ-MAPD combinations (OptiFree Express, RepleniSH and PureMoist) were evaluated for 4 or 6hr soak times respectively. Biocidal efficacy was performed according to methods described in ISO 14729. Efficacy (average of 3) was evaluated against clinical isolates of A. xylosidans, D. acidovirans and S. maltophilia. The challenge inoculum for each organism was prepared at approximately 5.0x10⁵ colony forming units (CFU)/ml. Organic soil was used following the ISO organism preparation guidelines.

CONCLUSIONS: The clinical isolates, Stenotrophomonas, Delftia, and Achromobacter have been cultured from lens cases of CLAIK patients. This study demonstrates the efficacy of a PMHB-PQ based MPS against these pathogens. The role of MPS formulation and preservative agent disinfection efficacy warrants further investigation in the prevention of infiltrative keratitis with daily wear of contact lenses.

115. **COMPARISON OF DAILY WEAR AND DAILY DISPOSABLE LENSES FOR ADVERSE EVENTS AND SUBJECTIVE COMFORT** (125444)

Jennie Diec, BOptom(Hons), Percy Lazon de la Jara, PhD, Eric Basil Papas, PhD, MCOptom, FAAO, Thomas Naduvilath, PhD, Brien A. Holden, PhD, DSc, FAAO, Brien Holden Vision Institute

RESULTS: Across the two lens wearing modalities, overall AE rate was lower for DD compared to DW lenses (3.1% vs. 10.9%, p=0.001). Corneal infiltrative events (CIE) was lower for DD compared to DW (3.1% vs. 8.1%, p=0.007). In DW trials, CIE rates were lower for peroxide solutions compared to multipurpose solutions (MPS) (3.3% vs. 10.3%, p<0.001). However, within MPS, there was no difference between PHMB and Polyquad based solutions (10.9% vs. 10.0%, p=0.9). There was no difference between DD and DW

trials for rates of SEAL (0.0% vs. 1.9%, p=0.1) and CLPC (0.0% vs. 1.0%, p=0.4), nor were there differences between peroxide and MPS for rates of SEAL (0.9% vs. 2.4%, p=0.2) and CLPC (1.5% vs. 0.7%, p=0.1). Average comfort on insertion ratings was no different between DD and DW (8.4 ± 1.4 vs. 8.3 ± 1.5, p=0.4) but was lower in DW for comfort at end of day (7.6 ± 1.7 vs. 7.2 ± 1.8, p=0.01). Within DW, MPS gave lower comfort on insertion compared to peroxide (8.2 ± 1.5 vs. 8.5 ± 1.4, p=0.02) but there was no difference at end of day (7.1 ± 1.8 vs. 7.3 ± 1.8, p=0.08).
PURPOSE: To compare adverse events (AE) and subjective comfort ratings between daily wear (DW) and daily disposable (DD) contact lenses.
METHODS: Retrospective analysis of approximately forty participants in each of 24 DW (lens / solution combinations) and four DD trials was performed. Participants attended visits at baseline, 2 week, 1 and 3 months. Subjective comfort ratings on a 1-10 scale and AE data as percentage of participants were collected at each follow up visit. The AE and subjective comfort rating results were compared between DW and DD trials and within DW trials, they were compared between the lens care products.
CONCLUSIONS: DD showed lower rates of CIE and better end of day comfort compared to DW. Amongst DW, trials using peroxide showed lower rates of CIE and increased comfort upon insertion. DD or use of peroxide in DW should be the first choice for reducing CIE

116. **PATIENT SATISFACTION WITH MULTIPURPOSE SOLUTIONS IN OVER 3000 SUBJECTS** (125638)
Mohinder M. Merchea, OD, PhD, FAAO, Kristen Bednar, Marianne Doktor, Kirk M. Bateman, Bausch+Lomb Inc.

RESULTS: Over 3000 patients that used a new MPS (PHMB-PQ) for at least 4 days before completed the survey. Ninety-five percent said they were satisfied with MPS (PHMB-PQ), and 89% said MPS (PHMB-PQ) was more comfortable than their habitual lens care system. In addition, 86% preferred MPS (PHMB-PQ) to their habitual lens care system and 88% said it provided better end-of-day comfort. 85% were more willing to recommend their ECP office after being prescribed MPS (PHMB-PQ) and 87% said they intended continue to use MPS (PHMB-PQ) after the study.
PURPOSE: Lens wearing discomfort is often ascribed by patients to lifestyle or poor compliance habits versus to attributes of the lens and lens care system used; and eye care practitioners (ECP) often do not actively prescribe changes in lens care regimens or are resistant to change their recommendation because symptoms are unarticulated. The purpose of this study was to evaluate patient acceptance of multi-purpose solutions with multiple lens material types through the use of an out-of-office Internet survey in a large sample of patients.
METHODS: 590 independent ECPs switched consecutive daily wear subjects from their habitual MPS (PQ-Aldox, PHMB, PHMB-Alexidine and others) or peroxide lens care system into a new MPS (PHMB-PQ). Subjects continued to use habitual contact lens types with the new MPS. Subjects were asked to report their experience with habitual lens wear, solution type, lens type, and symptoms they experienced to allow for data segmentation. Subjects were instructed to complete an Internet survey after about 7 days of use of the new MPS to assess satisfaction using a standard agree/disagree 6-point

scale.
CONCLUSIONS: Patients reported a high level of satisfaction when switched to MPS (PHMB-PQ) in a large patient sample after at least 4 days of use versus their habitual lens care system. This study highlights the importance of uncovering unarticulated patient symptoms and the benefit of ECP lens care system recommendations.

117. **INVESTIGATION OF BACTERIA CULTURED FROM MULTIPURPOSE DISINFECTING SOLUTIONS OF CORNEAL INFILTRATE EVENT PATIENTS** (125445)

Nancy A. Brady, BS, University of Leicester, Joseph P. Shovlin, OD, FAAO, Scranton, PA, Marina Nikolic, BSc, Anthony Lam, BS, Abbott Medical Optics Inc., Simon Kilvington, PhD, University of Leicester

RESULTS: 89% of these CLSC contained counts of 104-108 /mL. All were Gram negative: 56% contained Achromobacter spp., 22% Stenotrophomonas maltophilia, 17% Serratia marcescens, 11% Delftia spp, and 33% Elizabethkingia spp. These bacteria were then used for biocidal testing. For MPDS-1, Achromobacter showed 0-0.3 log kill; S. maltophilia showed 0.7-2.0 log kill and regrowth with 2 strains; Delftia gave 0.6-2.0 log kill and 1-2 log regrowth. For S. marcescens and Elizabethkingia, <1 log kill occurred. For MPDS-2, Achromobacter showed 2-5 log kill, all S. maltophilia, Delftia, and S. marcescens gave >4 log kill and 0.4-1.4 log with Elizabethkingia. MPDS-3, Achromobacter spp. show 3-5 log kill and all other bacteria gave 3-5 log kill with no regrowth
PURPOSE: Adverse events such as corneal infiltrates are being reported with increasing frequency in contact lens wearers and may be related to specific multipurpose disinfecting solution (MPDS). Bacteria from the contact lens storage cases (CLSC) of corneal infiltrate patients were assessed and these bacteria were tested for their efficacy against 3 MPDS.
METHODS: 18 CLSC from patients with corneal infiltrates were cultured. All reported using the same MPDS (MPDS-1) with 10 ppm PQ1, 5 ppm Aldox, + nonanoyl EDTA. Bacteria were identified then tested for their sensitivity to MPDS-1, MPSD-2 (3 ppm PQ1 + 1.6 ppm alexidine) and MPDS-3 (1 ppm PQ1+ 1.3 ppm PHMB), according to ISO 14729.
CONCLUSIONS: Bacteria such as Achromobacter, Stenotrophomonas and Delftia are inherently resistant to MPDS based on PQ1-Aldox and can even grow in the solution. It is notable that all the lens cases from patients with corneal infiltrates used the same MPDS and that 75% of their storage cases contained significant bacterial contamination. It is possible that such a bioburden may initiate an immunological response in the cornea resulting in infiltrative events.

118. **EFFICACY OF CONTACT LENS DISINFECTING SOLUTIONS AGAINST CORNEAL ISOLATES OF FUSARIUM SPP** (125586)

Marina Nikolic, BS, Abbott Medical Optics, Simon Kilvington, University of Leicester, Nancy A. Brady, BS, Santa Ana, CA

RESULTS: MPS-1 and MPS-2 gave 3-5 Log kill with all strains at 6 hr disinfection. MPS-3 gave a 2-4 Log kill at 6 hr for 8/10 strains and 0.6 -1.4 Log 2/10. MPS-4 showed 2-4 Log kill at 6 hr for 8/10 strains and 1.0 -1.4 Log for 2/10. Per-1 gave 1-3 Log kill for 4/10 strains at 6 hr and 0.1-0.8 Log for 6/10 (including ATCC 36031). PVI-1 gave 3-5 Log kill for seven strains tested by 4 hr, with no increased kill by 24 hr. Regrowth of Fusarium was not observed in any of the MPSs over 21 days but did occur for Per-1 by 7 days (1-2 Log increase) and PVI-1 (2-4 Log increase).
PURPOSE: Fusarium solani and F. oxysporum can cause fungal keratitis in contact lens wearers and an outbreak of infection in 2005-2006 was attributed to use of a multipurpose disinfectant solution (MPS). ISO 14729 requires a 1 Log kill of F. solani (ATCC 36031) within the manufacturers recommended disinfection time to meet the stand-alone biocidal criteria.
METHODS: Contact lens care solutions and their biocidal agents were: MPS-1 (PQ-1 with alexidine), MPS-2 (PQ-1 with PHMB), MPS-3 (PQ-1 + 6 ppm MAPD), MPS-4 (PQ-1 + 5 ppm MAPD + nonanoyl-EDTA), Per-1 (1-step hydrogen peroxide + platinum neutralizing disc) and PVI-1 (povidone iodine + neutralizing tablet). Ten Fusarium spp. (including F. solani ATCC 36031) were tested. Fusarium strains were grown on potato dextrose agar in the dark for 10 days and tested according to ISO 14729 with incubation times of up to 21 days.
CONCLUSIONS: All MPSs met the ISO 14729 stand-alone biocidal criteria for F. solani (ATCC 36031). MPS-1 and MPS-2 showed greatest efficacy against all the strains compared to MPS-3 and MPS-4. Disinfecting systems that employ a neutralization step do not have continued antimicrobial presence to prevent surviving organism growth during storage. The findings of this study indicate that contact lenses should be disinfected before use if stored for prolonged periods in a neutralized care system.

119. **ISSUES AND SYMPTOMS EXPERIENCED DURING SOFT CONTACT LENS WEAR WHILE USING HYDROGEN PEROXIDE SOLUTIONS** (125993)
Marjorie J. Rah, OD, PhD, FAAO, Carla J. Mack, OD, MBA, FAAO, Bausch+Lomb Inc.

RESULTS: Better cleaning and disinfection was the primary reason patients reported for using an HP solution (27% Germany; 34% US); however 71% of German and 52% of US HP users experienced issues as a result of wearing contact lenses (such as after long hours at a computer screen, in air conditioned or smoky environments, or while watching TV or a film). In both markets, patients experienced dry eyes (33% Germany; 25% US), and vision issues such as blurry or hazy vision, or poor vision (24% Germany; 25% US). Around one in three HP users felt the need to use eye drops regularly (27% Germany; 31% US).
PURPOSE: Hydrogen Peroxide (HP) care systems represent 10% of US and 30% of the German market. Eye care professionals primarily recommend peroxide systems for good cleaning and disinfection, for sensitive eyes, and patients for whom multi-purpose solutions are not working. Research was undertaken to understand to what extent current HP soft lens care systems meet the needs of soft contact lens (SCL) wearers.
METHODS: 300 SCL wearers (150 Germany; 150 United States), who wore SCL 4 days a week or more and used an HP solution completed an online survey, which included questions around issues and symptoms experienced during lens wear and how

these problems were dealt with.
CONCLUSIONS: Despite the superior cleaning and disinfection obtained with the current HP solutions, patients experienced unresolved issues while wearing lenses. Opportunity exists for HP products to be developed/advanced to better meet patients' needs by addressing these issues.

120. **CASE REPORT: CAN SICS BE OBSERVED WITH ROSE BENGAL AND LISSAMINE GREEN?** (125372)
Carole Maldonado-Codina, PhD, MCOptom, FAAO, Michael L. Read, PhD, MCOptom, PhD, Philip B. Morgan, BSc(Hons), PhD, MCOptom, FAAO, FBCLA, Eurolens Research, The University of Manchester

BACKGROUND: Solution-induced corneal staining (SICS) is a well-documented phenomenon occurring with certain combinations of hydrogel lenses and multi-purpose solutions and is traditionally observed with the aid of sodium fluorescein ('fluorescein', FL). To our knowledge, no reports exist of other ophthalmic dyes being used to observe SICS. This case report investigates whether or not rose bengal (RB) and lissamine green (LG) can be used to visualize SICS and if so, if co-localization of 'staining' occurs with FL.
CASE REPORT(S): A subject wore a pair of PureVision lenses (which had been soaked overnight in ReNu MultiPlus) for 2 hours on three separate days (at least 24 hours apart). Following lens removal, both corneas were examined after application of FL preceded or followed by the application of RB or LG. All corneas exhibited a typical SICS-type response after the application for FL. No staining-type response was observed with RB. Each punctate area which 'stained' with LG also 'stained' with FL, although additional regions of FL 'staining' were also observed which did not 'stain' with LG. The order of application of the ophthalmic dyes (i.e. FL before or after RB or LG) did not affect the findings.
CONCLUSIONS: This case report demonstrates that SICS can be visualized using LG but not RB. There appears to be co-localization of FL and LG 'staining' although some areas with only FL 'staining' were present when both dyes were used; i.e. LG staining was a subset within the FL staining. These observations are likely to be useful to researchers trying to determine the cellular or other mechanisms driving this phenomenon.

121. **SOLUTION-INDUCED-CORNEAL-STAINING (SICS): SYMPTOMS AND STAINING PATTERNS** (125625)
Jill Woods, BSc(Hons), MCOptom, Nancy J. Keir, OD, PhD, FAAO, Lyndon W. Jones, University of Waterloo, Centre for Contact Lens Research

RESULTS: Sixteen participants (80%) reported symptoms at various stages of the study; only 4 participants (20%) were totally symptom free. Stinging, burning and itching (in this order) were the most commonly reported symptoms during the study period, other than lens awareness. The numbers of participants reporting one or more of these three symptoms across the study were as follows: 2 prior to lens insertion; 6 post lens insertion; 5 after 2 hours lens wear; 13 following lens removal. All twenty participants exhibited SICS (diffuse punctate stain in four or more corneal zones; Carnt et al. CL Spectrum;

Sept 2007). Only one participant (5%) exhibited an annular SICS pattern, with lower central staining compared to the peripheral zones; the other 19 (95%) exhibited similar staining across all zones (pan-corneal). The mean staining area across all participants and all zones was 92% (stdev 13%).
PURPOSE: There has been considerable debate regarding the mechanism and clinical relevance of solution-induced corneal staining (SICS). A pilot study was undertaken to investigate various aspects of SICS and the symptoms and typical presentation pattern are reported here.
METHODS: Twenty participants wore balafilcon A lenses (PureVisionTM) soaked overnight in a PHMB preserved lens-care solution (renu freshTM). Symptom data was collected immediately before and after lens insertion and lens removal. After 2 hours of wear, the lenses were removed and the area of corneal staining was graded.
CONCLUSIONS: Symptoms related to SICS were reported by 80% of participants at some point during the study, and were most prevalent upon lens removal. Overall, stinging was the most commonly reported symptom. Some participants remained symptom-free despite exhibiting high levels of SICS. The pan-corneal staining pattern of SICS was far more prevalent than the annular pattern with this lens and lens-care combination.

122. **DEVELOPMENT OF A SOFT CONTACT LENS RISK ASSESSMENT SURVEY** (125021)

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RESULTS: An electronic, branching-logic, self-administered survey was fielded in 363 SCL wearers. On average, it took subjects 14 minutes to complete. Age-related differences were found for internal (i.e. stress, cold/flu), external (living environment) and SCL-related factors (sleeping in SCL, replacement, storage and care, exposure to water) (all $p<0.05$). Retest of 119 subjects showed substantial agreement ($Kw>0.6$) for most items where only one choice was allowed. Items with $Kw<0.6$ were primarily related to SCL and case cleaning, and self-management of potential red-eye events.
PURPOSE: Increasing numbers of children and young adults will likely be prescribed contact lenses for both cosmetic purposes and myopia control. Previous research has shown increased risk of soft contact lens (SCL) complications in 14-25 year old wearers, but there is little evidence of risk factors outside a controlled clinical trial for this age group. The CLAY study group sought to develop a survey to assess potential risk factors specific to teen and young adult SCL wearers.
METHODS: Survey items were selected via literature review, retrospective chart review of SCL-related red-eye exams, gap analysis, and focus groups with both eye care providers and children/teens. The survey was fielded to a non-clinical, age-balanced

sample of teenagers and adults at 5 geographically and ethnically diverse cities in the US. Retesting was conducted within 2 weeks and results were analyzed with weighted kappa (Kw).
CONCLUSIONS: The CLAY risk assessment survey detected age-related differences in multiple factors (concurrent validity) and showed high test-retest agreement (reliability). Many of these factors are also related to serious and significant SCL complications, but a prospective study in an active red-eye population is necessary to further refine the survey and examine predictive validity. The final risk assessment survey could be used as a pre-exam tool to educate patients about safe and healthy SCL wear.
ADDITIONAL COMMENTS: Suport: unrestricted grant from Alcon, Ltd.; Chancellor's Research and Development Grant from Nova Southeastern University.

123. **COMFORT QUESTIONNAIRE COMPARISON OF THREE POPULAR SILICONE-HYDROGEL SOFT CONTACT LENSES** (125898)
Daniel G. Fuller, OD, FAAO, Kristal Jones, Southern College of Optometry, Charles G. Connor, PhD, OD, FAAO, University of the Incarnate Word Rosenberg School of Optometry

RESULTS: Symptoms revealed to show a statistically significant difference included stinging (9.66,p=0.008), severity of stinging (9.38,p=0.0092) and tired feeling eyes (6.62,p=0.0365). Post hoc analysis of minimum significant difference by Siegal-Castellan test, found statistically significant greater comfort ($p< 0.05$) reported for Acuvue Oasys on items related to symptoms of dryness intensity, gritty feeling, stinging, intensity of stinging, eyes feeling tired and intensity of tired feeling. No statistically significant difference was found on any item between comparisons of Air Optix Aqua and Purevision.
PURPOSE: Despite all the advances in SiHy lenses, contact lens comfort remains a major issue for patients and doctor. This study addresses the comfort question using a qualitative cohort design to compare three popular silicone-hydrogel soft contact lenses on the basis of subjective symptoms and severity using a comfort questionnaire of our own design.
METHODS: One hundred and forty seven subjects were selected from a sequential search of recent invoices based on lens series and material. A response rate of 38.1% was obtained (n=56), females=40, males=16, mean age 33.2+14 years. Lenses studied were Air Optix Aqua® (lotrafilcon A), n= 50; Purevision® (balafilcon A), n=38; Acuvue Oasys® (senofilcon A), n= 59. A twelve-item, 7-point, Likert questionnaire was administered by telephone using a script by a single investigator. Kruskal-Wallis and post-hoc statistical testing was then performed on the data.
CONCLUSIONS: Subjects reported significantly less symptoms with Acuvue Oasys than with either Air Optix Aqua or Purevision. There was no difference in comfort between Air Optix Aqua and Purevision. Findings suggest questions about stinging, intensity of stinging and tiredness were of particular value in discriminating between comfort differences between silicone-hydrogel lenses.

124. **VISUAL PERFORMANCE OF MULTIFOCAL CONTACT LENSES** (125391)

Balamurali Vasudevan, BSOptom, MS, FAAO, Sara N. Gaib, OD, FAAO, Midwestern University Arizona College of Optometry

RESULTS: Mean logMARvisual acuity with spectacles, Acuvue Oasys, AirOptix and Biofinity for high contrast is -0.09 (SD=0.04), -0.08 (SD=0.03), -0.10 (SD=0.01) and -0.07 (SD=0.04), while that for low contrast is -0.05 (SD=0.05), -0.08 (SD=0.04), -0.06 (SD=0.04) and -0.02 (SD=0.06). Mean high contrast near visual acuity with spectacles, Acuvue Oasys, AirOptix and Biofinity is -0.09 (SD=0.02), -0.10 (SD=0.00), -0.10 (SD=0.01) and -0.10 (SD=0.01). Mean area under the curve for the contrast sensitivity test with spectacles, Acuvue Oasys, AirOptix and Biofinity is 26.51 (SD=1.50), 25.90 (SD=1.04), 26.61(SD=0.76) and 26.28(SD=1.26) respectively. ANOVA revealed no significant difference in high and low contrast distance visual acuity as well as near visual acuity and contrast sensitivity function between the 3 multifocal contact lenses and spectacles ($p>0.05$).

PURPOSE: The aim of the present study was to compare the visual performance of different multifocal contact lenses.

METHODS: 10 subjects (habitual soft contact lens wearers) between the ages of 40-45 years participated in the study. Three different multifocal contact lenses were fitted within the same visit. Visual performance tests were performed that included low and high contrast distance visual acuity, near visual acuity, contrast sensitivity (CSV-1000; OU; logarithmic scale for 3, 6, 12 and 18cpd), range of clear vision (OU) and through-focus curve (OU, low contrast). Visual performance was obtained with the subject's spectacles as well as with Acuvue Oasys, AirOptix and Biofinity low-add multifocal contact lenses. All the lenses were fit according to the fitting guide.

CONCLUSIONS: There was no statistically significant difference between the three different low-add power multifocal contact lenses and the spectacles. Objective visual performance was similar between the 3 different types of contact lenses.

125. **PERFORMANCE OF A NOVEL HYDROGEL LENS AMONG PATIENTS BOTHERED BY BLURRINESS OR FLUCTUATING VISION** (125595)

William T. Reindel, OD, MS, Lening Zhang, PhD, Siva Raj, MA, MBA, Robert Steffen, OD, MS, Bausch+Lomb Inc.

RESULTS: A total of 414 eligible subjects enrolled (210 DD/204 PRP). There was no significant difference in SLE > Grade 2 findings between Dispensing and 2 week visits. There were no adverse events. In comparing the HyperGel lens performance to the subject's habitual lens performance, the HyperGel lens was rated better for comfortable vision: throughout the day (3.8:1), in dry environments (3.9:1), working for long hours at computer (4.0:1), looking for a long time at smartphone or tablet (4.7:1), and driving at night (5.5:1). The HyperGel lens was also rated better for: comfortable throughout day (3.7:1), prevent eye from feeling tired or fatigued (3.6:1) and maintain healthy, white eyes (5.5:1). Preference differences were statistically significant ($p<0.05$).

PURPOSE: Recent research indicated 2 out of 3 contact lens wearer experience symptoms of blurry or fluctuating vision, or discomfort symptoms like dryness or tired

eyes. The purpose of this study was to evaluate a unique 78% water hydrogel polymer (nesofilcon A/HyperGel) designed to prevent dehydration and maintain a steady optical surface among a population of subjects that were bothered by blurriness or fluctuations in vision with their current contact lenses.
METHODS: Subjects bothered by blurriness or fluctuations in vision with their current contact lenses were enrolled into this 2 week, single arm, bilateral, open-label study. Patients were enrolled by 21 independent investigators. Following 7 days of daily disposable wear, subjects completed an internet survey to capture their perspectives regarding the product. Investigators completed slit lamp examinations (SLE) and exited the subjects, after 2 weeks of product use.
CONCLUSIONS: Contact lens wearers live and work in a range of environmental conditions that result in experiences of blurry or fluctuating vision, or discomfort symptoms like dryness or tired eyes. The performance ratings demonstrated that the novel 78% water HyperGel material can help practitioners improve patient's experiences with contact lens.

126. **CORNEOSCLERAL GP CONTACT LENSES: NOT TOO BIG, NOT TOO SMALL, BUT JUST RIGHT** (125971)

Pam T. Satjawatcharaphong, OD, University of California Berkeley School of Optometry

BACKGROUND: This case demonstrates the successful use of a corneoscleral GP contact lens in a post-penetrating keratoplasty, low vision patient when both corneal and scleral GP lenses failed.
CASE REPORT(S): JP, a 51 year old Caucasian female, presented with diabetic retinopathy OU, glaucoma OU, retinal detachment OS, and ocular herpes OS. Subsequent to enucleation OD she was fit with a prosthetic eye. Surgical efforts were made to save her remaining eye, including two PKs, PCIOL implant, shunt surgery, vitrectomy, scleral buckle, and several retinal laser procedures. JP's chief complaint was poor vision OS and her ultimate goal was to utilize low vision aids. Incoming VAs were NLP OD and LP OS. She reported past attempts to fit her eye with a scleral lens were unsuccessful due to the irregular shape of her sclera after scleral buckle surgery. Since lenses did not contour her sclera well, bubbles would enter beneath the lens and it would eject. My initial diagnostic lens was an intralimbal corneal GP (10.8mm OAD). VA improved to 20/250, but the fit was not ideal as the lens exhibited minimal movement. The patient reported that her eye became dry and vision deteriorated with long wear time. The next lens trialed was a small scleral lens (15.0mm OAD) to try to minimize involvement of her irregular sclera. This lens appeared to fit well initially, but like previous sclerals it ejected from the eye. The final lens design was a corneoscleral lens (14.4mm OAD). This lens shared bearing between the cornea and sclera, did not eject or form bubbles, and allowed for good centration and tear exchange. VA with this lens was 20/200 and the patient felt the lens was comfortable.
CONCLUSIONS: For patients with challenging corneal and scleral anatomy, lens design and overall diameter can play a crucial role in fitting failure versus success. JP had both an irregular cornea and sclera making it difficult to find a lens that would fit properly. However, with the vast variety of lens designs available today there is likely an option that will fit even the most challenging eye shapes and conditions.

127. **CLINICAL EVALUATION OF A LARGE DIAMETER RIGID-GAS PERMEABLE LENS FOR THE CORRECTION OF REFRACTIVE ASTIGMATISM** (125085)

Langis Michaud, OD, FAAO, University of Montreal School of Optometry, Stephanie Woo, OD, Edward S. Bennett, OD, MSEd, FAAO, University of Missouri-St. Louis School of Optometry, Amy E. Dinardo, OD, MBA, FAAO, Bruce W. Morgan, OD, FAAO, Michigan College of Optometry, Renee E. Reeder, OD, FAAO, Jennifer S. Harthan, OD, FAAO, Illinois College of Optometry

RESULTS: 40 patients (10/sites) were enrolled and 35 have completed the study. Four were lost for follow-up and one was not able to be fitted with soft lens. All others subjects were successfully fitted with both soft and rigid lenses. Low contrast VA at distance was better with the use of RGP lenses. At the end of the study, subjects have rated their subjective visual acuity as better with RGP lenses ($p<0.05$). Comfort was rathed similar by 29/35 of the subjects. At the end, 72% (25/35) of the subjects preferred to remain in RGP lenses instead of soft lenses and have selected them as their lens of choice.

PURPOSE: This study aims to validate the clinical performance of a new large diameter rigid gas permeable lens in a group of subjects with low to moderate (0.75D to 2.75 D) refractive astigmatism. It aims also to demonstrate whether soft toric or large diameter rigid gas-permeable (LRGP) contact lenses offer the best option for the correction of ametropia and to determine which modality is preferred by subjects.

METHODS: Forty subjects, soft contact lens wearers, are randomly assigned to Group A or Group B. Group A is fitted first with the soft lens (Biofinity toric, Cooper Vision) and then switches to the LRGP lenses (Blanchard, OneFit P&A Lens). Group B starts with LRGP lenses and ends the study being fitted with soft lenses. For each type of lens worn, low- and high-contrast visual acuity (VA) are evaluated at both near and far. At the end of the study, each subject is asked to indicate their preference for one type of lens and will rate the quality of vision in day-to-day activities through a questionnaire.

CONCLUSIONS: Large diameter RGP lenses outperform soft toric disposable lenses on a group of healthy young soft contact lens wearers, based on the better visual acuity provided. RGP lenses were rated as comfortable as the soft ones. Consequently, large diameter RGP lenses can be considered as a valuable option for the correction of current refractive errors.

ADDITIONAL COMMENTS: 3 authors are contact lens resident (Drs Woo, Dinardo and Hathan)

128. **EVALUATION OF THE ROTATION OF LARGE DIAMETER GAS PERMEABLE LENSES ON THE CORNEA** (125312)

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RESULTS: 24 subjects were adapted successfully. Despite a high inter-subjects variation, the One Fit lens (OF) offers in average a lower rotation than the Maxim (MX). Both lenses rotate counterclockwise if fitted aligned (C1) or with a steeper curvature (C2

-higher sag) (C1: OF 1,2 o MX18,9o, C2: OF 2,3o MX 7,7 o) while they rotate clockwise if fitted flatter (C3 : OF 11,6 o ; MX 18,5 o). Overall, the inter-subject difference is significant according to the type of lenses (OF vs MX, p=0.027) and not according to the way they are fitted. Intra-subject analysis shows the opposite; the base curve becoming a significant factor. As expected, for both lenses, clearance is significantly reduced toward flatter fits. Because of the flatter fit, at that time lens tends to adopt a clockwise rotation.
PURPOSE: This study aims to determine if large diameter rigid gas permeable lenses rotate on low-toric corneas and to evaluate how the clearance affects this movement.
METHODS: Healthy subjects from 18 to 40 years old are recruited. One eye, randomly selected, is fitted with a mini-scleral (OneFit P&A, Blanchard Labs, Sherbrooke, QC) and, later, with a semi-scleral lens (Maxim, Acculens, Denver, CO). Every subject is randomly adapted with both lenses, first with the base curve/sag that matches the flattest K of the cornea, as measured with Medmont topographer. The same lens is also fitted with a flatter and a steeper curvature (higher and lower sag). Clearance, for each fit, is evaluated through an OCT exam. Lenses being inserted with a mark at 6 o'clock position, rotation of each lens is evaluated under the slit lamp after 25 minutes of wear. Results were analyzed using ANOVA parametric tests and Pearson linear correlation.
CONCLUSIONS: Large diameter rigid gas permeable lenses move on the ocular surface. However, this movement does not exceed 20% of rotation for the lenses tested. The orientation and amplitude of movement are influenced by the clearance. Larger clearance leads to higher counter-clockwise rotation while flatter fits tend to produce clockwise ones.

129. **FITTING SCLERAL CONTACT LENSES UTILIZING VISANTE OCT IMAGING** (125487)

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RESULTS: The finished lenses were appreciably flatter fitting than what was predicted from Visante OCT imaging. For example, the corneal clearance over the base curve of the first patient's lens was predicted at 300 µm, while the actual clearance was 60 µm. This decrease in total sagittal depth is hypothesized to stem from standard proprietary eccentricity values incorporated into the radial curves of the Jupiter scleral lens design. While having insufficient corneal clearance, the lens alignment to the contour of the scleral conjunctiva was judged to be clinically acceptable.
PURPOSE: To utilize data collected from the Visante OCT to calculate radius of curvatures for empirical scleral contact lens fitting.
METHODS: This is a retrospective case study of two irregular cornea patients referred to the University Eye Institute Cornea and Contact Lens Service for a monocular scleral contact lens fitting. Both patients were fitted based on measurements derived from anterior segment ocular coherence tomography (OCT). Visante OCT horizontal line scans and corneal topography were acquired on the eye of interest in both patients and utilized to design the back surface radius of curvatures for a scleral contact lens.

Eccentricity was taken into account when determining the base curve of the first patient's lens and the second patient's lens was spherical. Calculated values were used in the manufacture of a Jupiter scleral lens design. The finished lenses were assessed on eye with a biomicroscope for corneal clearance and alignment over the conjunctival vessels. Additionally, horizontal line Visante OCT was performed over the lens for each patient.
CONCLUSIONS: Accurate custom design of back surface of a scleral lens should take into account eccentricity values and their impact on sagittal depth. Nevertheless, our data points towards the likelihood of utilizing high resolution anterior segment imaging for the purpose of fully customizing a scleral contact lens.
ADDITIONAL COMMENTS: We give special thanks to Hope Queener (NEI P30 EY007551) for assistance in creating the software for fitting the lens curves.

130. **THE SHORT-TERM EFFECT OF ORTHOKERATOLOGY TREATMENT ON TEENAGE MYOPIA: ANALYSIS OF CORNEAL TOPOGRAPHY AND SUBJECTIVE REFRACTION** (125503)
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RESULTS: The average myopic spherical refractive error (SE) was -2.75&plusmn1.14D at base line. After 2 weeks overnight orthokeratology treatment, the spherical RE was significantly reduced to -0.17&plusmn0.79D (P<0.01). The linear regression (R&sup2) analysis showed that in Equation 1: R&sup2=0.354, Equation 2: R&sup2=0.477, and Equation 3: R&sup2=0.463. All three R&sup2 showed that the subjective refraction changes were higher than the topography power changes.
PURPOSE: To observe short-term effects of overnight orthokeratology treatment on teenage myopic patients analyzed by corneal topography and subjective refraction.
METHODS: Thirty-two subjects aged from 8 to 19 (11.81&plusmn2.81) years undertaken overnight orthokeratology treatment were included. The corneal topography and subjective refraction were performed before and 2 weeks after the treatment. The refractive changes measured by corneal topography and subjective refraction described by linear regression analysis by following equations: Equation 1: SRC=0.582SK+1.583 (SRC: subjective refractive changes, SK: corneal topographic steep k valve changes); Equation 2: SRC=0.722FK+1.223 (FK: corneal topographic flat k valve changes); Equation 3: SRC=0.730AK+1.167 (AK: corneal topographic average k valve changes).
CONCLUSIONS: Corneal topographic power changes slighted underestimated the refractive changes by means of steep K, flat K or average K value. The corneal topography is still a powerful tool to predict subjective refraction after orthokeratology treatment in teenage.