



The European Academy
of Optometry and Optics

Research and Academic Symposium Oral and poster presentations



Abstracts



The European Academy
of Optometry and Optics

Introduction

The European Academy of Optometry and Optics - inaugural Research and Academic Symposium

I am delighted to welcome you to the inaugural meeting of the European Academy's Research and Academic Symposium.

This Symposium brings together key stakeholders from across Europe to discuss and disseminate the latest research relating to optometry, optics and vision science. I am very pleased that this event has been incorporated into the European Council of Optometry and Optics' (ECOO) Spring meeting.

The development of the Academy is a milestone for optometry in Europe. The Academy has been established to promote clinical, educational and scientific excellence that transcends geographical barriers. The Academy will provide members with a much needed voice to help advance the profession, develop the scientific knowledge base and support and promote lifelong learning for optometrists and opticians across Europe.

This symposium programme is exciting, ambitious and addresses some of the key issues facing our profession across Europe. This weekend's programme includes a broad range of presentations, delivered by researchers from a variety of backgrounds. The Symposium will help participants to keep up to date with the latest research and new ideas and will provide a key channel to support participants in their work to disseminate and share research, information and best practice.

The Research and Academic Symposium will become an important event for optometrists, opticians, educationalists, vision scientists and researchers within Europe. The presentations we'll hear over the coming weekend demonstrate the quality and breadth of the research that is being undertaken across Europe – I look forward to working with you, through the Academy, to help build on this foundation, advancing and promoting research and excellence across Europe.

Feike Grit

President, European Academy of Optometry and Optics



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Programme

SATURDAY 16 MAY	
13.00 – 13.20	Wolfgang Cagnolati and Feike Grit Opening of the 1st European Academy Research and Academic Symposium
13.20 – 14.20 (Keynote Address)	Robert Harper Glaucoma: Challenges and opportunities for optometry
14.20 – 15.55	Poster Presentations
16.00 – 17.40	<p>Tony Redmond Relating retinal nerve fibre layer thickness and functional measures of localised ganglion cell density in Glaucoma</p> <p>Holger Dietze Optometrists can reliably screen for glaucoma</p> <p>Ditipraya Mukhopadhyay Comparison of central and mid-peripheral corneal thickness measurements with Orbscan II, Pentacam and Ultrasound Pachymetry</p> <p>Frank Epejesi Repeatability of a reverse heterochromic flicker photometer in the measurement of macular pigment optical density</p> <p>Annemieke Coops Can we always trust the data given by automated diagnostic equipment?</p>
SUNDAY 17 MAY	
08.00 – 09.00	Research and Academic Sessions
09.00 – 10.00 (Education Keynote)	<p>Josephine Mullin Developing a world class Scheme for Registration</p> <p>Rupal Lovel-Patel OSCE assessment - is it a fair way to assess clinical skills?</p>
10.05 – 11.05	<p>Mirjam van Tilborg Variation in stray light measurement with newly fitted soft contact lenses</p> <p>Daniela Nosch Where do we stand with Silicone Hydrogels?</p> <p>Paul Murphy P-Test: A new method for predicting dry eye symptoms in new contact lens wearers?</p>
11.30 – 12.50	<p>Peter Gumplayer 4 pillar model for low vision rehabilitation in upper Austria</p> <p>Jonathan Jackson Low vision: visual acuity, contrast sensitivity and the effect of luminance change</p> <p>J. Khadka The development of the Cardiff Visual Impairment ability questionnaire for children and young people (CVI AQC)</p> <p>Ian Davies The use of fluorescein in contact lens aftercare across Europe</p>



Relating retinal nerve fibre layer thickness and functional measures of localised Ganglion Cell density in Glaucoma

Presenter: Tony Redmond¹

Co-Authors: Margarita B Zlatkova¹, David F Garway-Heath^{2,3}, David P Crabb³, Roger S. Anderson^{1,2}.

¹Vision Science Research Group, University of Ulster, Coleraine, UK

²NIHR Biomedical Research Centre for Ophthalmology, Moorfields Eye Hospital NHS Foundation Trust, UCL Institute of Ophthalmology, London, UK

³Department of Visual Science, City University, Northampton Square, London, UK

Background

Standard automated perimetry (SAP) is currently the gold standard test for functional deficits in glaucoma and many studies have used its results to estimate the density of underlying retinal ganglion cells. Likewise, peripheral grating resolution acuity (PGRA) has been used, mainly in a laboratory setting, to estimate underlying ganglion cell density. However, these methods have never been compared and uncertainty still surrounds the relationship between retinal structure (e.g. thickness) and function.

Methods

22 patients with early POAG (MD < -8dB) and 26 age-similar normal subjects underwent SAP (HFAII: SITA-Standard 24-2) and measurement of PGRA at 4 locations at 10 degrees eccentricity. GC density at the 4 corresponding PGRA and SAP locations was estimated: PGRA using the method of Thibos et al (1987) and SAP from data reported in Garway-Heath et al (2000a). RNFLT was measured with a Zeiss Stratus OCT. Structure/function relationships for all subjects were assessed using the Garway-Heath et al (2000b) retinotopic map.

Results

RNFLT/GC associations appeared stronger (although not significantly; $p > 0.7$) in the upper than lower field (PGRA $r^2 = 0.23$ versus $r^2 = 0.13$; SAP $r^2 = 0.25$ versus $r^2 = 0.13$; all $p < 0.05$). The RNFLT/GC association appears curvilinear with SAP but linear with PGRA. SAP and PGRA method agreement for GC density was moderate, with larger disagreements becoming more apparent in areas of normal sensitivity. Relative (to PGRA) over-estimates of ganglion cell numbers arise from small increases in SAP threshold sensitivity at the upper end of the dB scale.

Conclusions

The association of RNFLT with functional GC numbers estimated from PGRA appears linear, whilst the association from SAP estimates appears curvilinear. SAP threshold measurements result in large errors in GC density estimates at locations of high sensitivity, owing in part to the large linear differences between incremental and decremental step size that result from the logarithmic SAP staircase.

References

1. Swanson WH, Felius J, Pan F (2004) Perimetric defects and ganglion cell damage: Interpreting linear relations using a two-stage neural model. *Invest Ophthalmol Vis Sci* **45**(2) p466-472
2. Garway-Heath DF, Caprioli J, Fitzke FW, Hitchings RA (2000a) Scaling the hill of vision: the physiological relationship between light sensitivity and ganglion cell numbers. *Invest Ophthalmol Vis Sci* **41**(7) p1774-1782
3. Garway-Heath DF, Poinoosawmy D, Fitzke FW, Hitchings RA (2000b) Mapping the visual field to the optic disc in normal tension glaucoma eyes. *Ophthalmology* **107**(10) p1809-1815
4. Thibos LN, Cheney FE, Walsh DJ (1987) Retinal limits to the detection and resolution of gratings. *J Opt Soc Am A* **4**(8) p1524-1529



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Optometrists can reliably test for Glaucoma

Presenter: Holger Dietze

Co-authors: Anne-Christine Uihlein

University of Applied Sciences, Berlin, GERMANY

Purpose

To compare optometric screening outcomes for glaucoma with the results of a complete eye assessment performed by an experienced ophthalmologist.

Methods

Both a qualified optometrist and a qualified ophthalmologist independently performed a complete glaucoma screening on 112 patients (> 40yrs) of an ophthalmologic outpatient-clinic. According to agreed criteria, patients were categorised into five categories (1 = normal; 2 = primary open angle glaucoma (POAG) suspected; 3 = POAG strongly suspected; 4 = secondary glaucoma suspected; 5 = other abnormalities suspected).

The methods used were taking family history, non-contact tonometry, undilated optic nerve head assessment with indirect ophthalmoscopy, FDT-perimetry, slit-lamp examination of the anterior eye segment and fundus photography. Vertical CD-ratios were estimated by indirect ophthalmoscopy and measured using fundus photography. Results for individual and combined methods were statistically compared.

Results

The overall-agreement for categorising the patients was 86,6% (CI 73,0 % - 95,0%), and the agreement in categorising patients as glaucoma-suspects (categories 2 and 3) was even higher at 97;9% (CI 90,5% - 100%). There was no statistically significant difference between the optometrist's and the ophthalmologist's estimations for the vertical CD-ratio. When the combined ophthalmologist's results were taken as a reference the sensitivity of the complete optometric glaucoma screening was 97,9%, and the specificity was 89,0%. It was significantly lower when only individual results were compared to the combined ophthalmologist's results.

Discussion and Conclusion

Given sufficient professional training and proper referral criteria optometrists can safely and effectively screen for glaucoma. The screening is most sensitive if the results obtained from tonometry and a number of other structural and functional tests are combined.



Comparison of central and mid-peripheral corneal thickness measurements with Orbscan IIz, Pentacam and ultrasound pachymetry

Presenter: Ditipriya R. Mukhopadhyay

Co-authors: R.V. North, K.E. Hamilton

School of Optometry and Vision Sciences, Cardiff University, Cardiff, UK

Background/Purpose

Recent work has shown that both central corneal thickness (CCT), and mid-peripheral corneal thickness (MCT), affect the accuracy of applanation tonometry. This was a clinical study to compare methods of CCT and MCT measurement using Orbscan IIz (Bausch + Lomb, USA), Pentacam (Oculus, Germany) and ultrasound pachymetry (Sonomed, USA), to determine the agreement between the three.

Methods

70 eyes of 35 normal subjects (20 female, 15 male; mean age 30.8±10.5 years) underwent 3 corneal thickness scans using Orbscan IIz and Pentacam, and 5 measurements using ultrasound pachymetry in each of 5 corneal locations. Ultrasound MCT readings were obtained by varying fixation to change corneal location of the ultrasound probe. Mean CCT and MCT at 2.5mm from the centre superiorly, nasally, inferiorly and temporally were analysed. Repeated measures ANOVA with Bonferroni correction was used to make pairwise comparisons between measurements from each instrument at each position. Coefficient of variation (CoV) was calculated for each instrument.

Results

Right eye results are summarised in the table below: Orbscan and ultrasound CCT were not significantly different (p=0.996), nor were Pentacam and ultrasound CCT (p=0.11). All other comparisons between instruments were significant in the mid-periphery (p<0.05); Orbscan MCT was highest and ultrasound MCT lowest in all positions. CoV for each method ranged from 5.1 to 7.5% in all positions.

Conclusions

To the best of our knowledge, this is the first study that compares these three instruments directly in the mid-periphery. For CCT, Orbscan and ultrasound show good agreement while Pentacam is significantly lower than both. Significant differences are found between instruments in measurements of four mid-peripheral locations. Therefore, the three methods cannot be interchanged reliably when considering corneal thickness beyond the centre. Ultrasound MCT values are lower than the other methods, possibly due to difficulty of correct probe placement 2.5mm out from the central cornea. CoV shows each method to have similarly low variability in all positions.

References

- Hamilton K (2009) Midperipheral Corneal Thickness Affects Noncontact Tonometry. Journal of Glaucoma Publish Ahead of Print.
- Parafita M, Yebra-Pimentel E, Giraldez M J, Gonzalez-Perez J, Perez-Martin M V P, and Gonzalez-Mejome J (1999) Further information on the knowledge of topographical corneal thickness. International Contact Lens Clinic 26: 128-137.

Corneal thickness values (mean ±SD) (µm)					
	Central	Superior	Nasa	Inferior	Temporal
Orbscan	554.0 ± 39.3	639.0 ± 38.1	634.2 ± 37.5	615.6 ± 34.4	591.3 ± 42.4
Pentacam	546.8 ± 40.0	625.1 ± 39.5	613.3 ± 38.3	591.1 ± 37.8	582.7 ± 42.1
Ultrasound	551.9 ± 38.7	564.9 ± 40.5	557.3 ± 36.7	557.6 ± 40.0	565.7 ± 38.3
Mean differences (µm) and significance (p)					
Orb-Pent	7.2 p=0.001	13.9 p<0.001	20.9 p<0.001	57.9 p<0.001	25.5 p<0.001
Orb-Ultra	2.2 p=0.996	74.1 p=0.002	76.9 p<0.001	24.5 p<0.001	8.5 p=0.017
Pent-Ultra	-5.1 p=0.11	60.2 p<0.001	56.0 p<0.001	33.5 p<0.001	17.0 p<0.001



Repeatability and reproducibility of a reverse heterochromic flicker photometer in the measurement of macular pigment optical density

Presenter: Frank Eperjesi

Co-Authors: Louise Stainer, Sandip Singh, Hannah Bartlett

Ophthalmic Research Group, Aston University, Birmingham, UK

Background

Low values of macular pigment optical density (MPOD—the ratio of foveal to parafoveal macular pigment) are associated with a greater risk of developing age-related macular degeneration (AMD) (Bone et al. 2001; Nolan et al. 2007). The macular pigment screener (MPS) is a novel desk top instrument that allows the measurement of MPOD in a clinical context using reverse heterochromic flicker photometry (van der Veen et al. 2009). Dietary modification and use of ocular nutritional supplements have been shown to increase MPOD in laboratory based studies. Average values have been found to be $0.299 (\pm 0.169)$ with a range of 0 to 0.848 and there is an age-related decrease of 0.03 every 10 years between the age of 20 and 60 (Nolan et al. 2007).

Aims

To determine the repeatability and reproducibility (i.e. measurement noise) of the MPS in order to be able to identify clinically significant changes in MPOD in the context of strategies for the prevention of AMD such as dietary modification and/or use of ocular nutritional supplements.

Method

Healthy volunteers underwent MPOD measurement by two investigators on two occasions separated by at least one week using the MPS. Four data measurements were made with each subject during the study. Optimum refractive correction was used where necessary; subjects received instructions and underwent a practice session prior to MPOD data being obtained.

Results

Twenty five subjects were recruited (19 F, 6M), with a mean age (\pm SD) 27.8 years (\pm 8.7). Bland and Altman analysis was used to determine the coefficient of repeatability: Investigator 1 versus (vs) Investigator 2 (first measurement pair) 0.19; Investigator 1 vs Investigator 2 (second measurement pair) 0.26; Investigator 1 (first measure) vs Investigator 1 (second measure) 0.26; Investigator 2 (first measure) vs Investigator 2 (second measure) 0.21.

Conclusions

When consecutive MPOD measures are taken for an individual by different practitioners (repeatability) then a change greater than 0.52 can be considered clinically significant. When consecutive MPOD measures are taken for an individual by the same practitioner (reproducibility) then a change greater than 0.51 can be considered clinically significant.

References

1. Bone RA, Landrum JT, Mayne ST, Gomez CM, Tibor SE, Twaroska EE. (2001). Macular pigment in donor eyes with and without AMD: a case-control study. *Invest Ophthalmol Vis Sci.* 42:235-40.
2. Nolan JM, Stack J, O' Donovan O, Loane E, Beatty S. (2007). Risk factors for age-related maculopathy are associated with a relative lack of macular pigment. *Exp Eye Res.* 84:61-74.
3. van der Veen RL, Berendschot TT, Hendrikse F, Carden D, Makridaki M, Murray IJ. (2009). A new desktop instrument for measuring macular pigment optical density based on a novel technique for setting flicker thresholds. *Ophthalmic Physiol Opt.* 29:127-37.



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Can we always trust the data given by automated diagnostic equipment?

Presenter: Annemieke Coops

Dutch Optometric Association

Background/Purpose

To analyse the diagnostic performance of the Heidelberg Retina Tomograph (HRT) and to investigate which parts are important to keep in mind when interpreting the HRT data of an individual patient in clinical practice.

Methods

Heidelberg Retina Tomograph (HRT) images were obtained from one eye of 123 glaucoma patients (mean age, 69.1 yrs; mean MD, -3.7, range +1.9 to -9.7 dB) and 96 healthy controls (mean age 59.6 yrs; mean MD -0.2, range +2.5 to -3.7 dB). For Moorfields Regression Analysis (MRA), contour lines were drawn by experienced clinicians. The diagnostic performances of Glaucoma Probability Score (GPS) and MRA were evaluated by including "borderline" classifications either as test-positives (most sensitive criteria) or as test-negatives (most specific criteria). Effects of disc size were evaluated by stratifying the sample into 3 equal subgroups based on disc area.

Results

In 5 (4%) of glaucoma patients, and 11 (8%) of controls, the GPS failed to provide a complete global and sectoral classification. While we could not identify a single distinct cause for failure in the glaucoma group, failures in the controls occurred most often (8/11) with small crowded discs. In those optic discs that were successfully classified the diagnostic performances of GPS and MRA were similar; ROC areas of 0.81 and 0.78, respectively. Both GPS and MRA classified small optic discs (<1.75 mm²) more conservatively (lower sensitivity and greater specificity) than medium and large discs ($p < 0.05$, chi-square test). With sectoral analysis, the GPS classifications within the individual disc sectors appeared strongly associated with each other.

Conclusions

The diagnostic performance of the contour-line independent GPS analysis was very similar to that of the MRA. However, clinicians need to take into account disc size when interpreting automated and semi-automated classification of optic disc status with the HRT. In large optic discs, both GPS and MRA are likely to produce many false positive classifications. Correspondingly, the sensitivity to early damage is likely to be low in small optic discs. GPS sectoral classification of the optic disc adds little if any information to that already available from the global classification.



Variation in straylight measurement with newly fitted soft contact lenses over a twelve hour period

Presenter: Mirjam van Tilborg¹

Co-Authors: Dave Edgar FCOptom²

¹University of Applied Science Hogeschool Utrecht

²Henry Wellcome Laboratories for Vision Sciences, Department of Optometry and Visual Science, City University, London, UK

Purpose

To investigate straylight in hydrogel contact lens wearers during the course of a 12 hour wearing period. Subjects wore newly fitted lenses, either silicone hydrogel lenses or conventional hydrogels.

Methods

Straylight measurements (log (s)) using the C-Quant system were obtained from 42 eyes of 21 healthy volunteer subjects. Straylight was measured every 2 hours for 12 hours beginning at 08.00hrs. Day 1 was the control situation, with log (s) measured over the 12 hour period without lenses being worn. During Day 2, log (s) was measured with contact lenses having been worn over the 12 hr period, and one extra set of measurements was taken one hour after removing the contact lenses. Subjects were divided into four different groups according to the contact lens material worn.

There were 10 subjects wearing lenses from FDA group I (Acuvue Oasys) and II (Proclear) and 11 subjects wearing lenses from FDA group III (Purevision) and IV (Focus). All the lenses had the same power (-0.50D) and were issued to the subjects in a randomised order. All the subjects were healthy optometry students from the Optometry department at the Hogeschool Utrecht. Prior to inclusion on the study all the eyes were examined (refraction, slitlamp examination, corneal topography, BUT and quick zone test). For the anterior segment of the eye, any pre-existing finding of grade two or higher score on any Efron scale (Efron, 1998) was considered unacceptable and led to exclusion from the study

Results

There were no significant differences between mean log (s) values with and without lenses for any lens type at any time point. However, individual subjects may exhibit increased log (s) values over the 12 hour period when wearing lenses. The overall effect on

scattered light for each subject over the 12 hour period was assessed by calculating the area under the curve (AUC) for log (s) plotted against time for each lens. There were no statistically significant differences between the means of the AUCs with and without contact lenses for any lens type.

Differences in log (s) at each time point were assessed using Altman/Bland agreement plots for each time point and for each lens type. The measurements of bias for log (s) for all lens types and for all time measurements were within the range ± 0.05 , with 71% (20/28) of the measurements of bias within ± 0.02 . The 95% limits of agreement for log (s) with and without lenses are greater at most time points for the Oasys and Proclear lenses than for the Purevision and Focus lenses.

Conclusions

There were no clinically or statistically significant increases in mean straylight with any of the tested lens types over a 12 hour wearing period for newly fitted lenses, nor was there any significant change in mean straylight one hour after lens removal.

References

1. Cox, I.G. (2000). The why and wherefore of soft lens visual performance. *Cont. Lens Anterior. Eye* 23, 3-9.
2. Efron, N. (1998). Grading scales for contact lens complications. *Ophthalmic and Physiological Optics* 18, 182-186.
3. Jones L, Senchyna M, *et al.* (2001). A comparative evaluation of lysozyme and lipid deposition on Etafilcon, Balafilcon and Lotrafilcon contact lens materials. *Invest Ophthalmol Vis Sci* 2001; 42;4: s593 #3186.
4. Jones L, Mann A, *et al.* (2000). An *in vivo* comparison of the kinetics of protein and lipid deposition on group II and group IV frequent-replacement contact lenses. *Optom Vis Sci* 2000; 77;10: 503-10.
5. Suwala, M., Glasier, M.A., Subbaraman, L.N., and Jones, L. (2007). Quantity and conformation of lysozyme deposited on conventional and silicone hydrogel contact lens materials using an *in vitro* model. *Eye Contact Lens* 33, 138-143.
6. van den Berg, T.J. (1986). Importance of pathological intraocular light scatter for visual disability. *Doc. Ophthalmol* 61, 327-333.



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Where do we stand with Silicone hydrogels?

Presenter: Daniela Nosch

Background

Changing environmental conditions such as pollution, air conditioning and prolonged computer work have rendered successful soft contact lens wear increasingly difficult. The growing numbers of dry eyes prove to be challenging for successful contact lens wear.

Silicone hydrogel contact lenses (SHCLs) promise to address these growing expectations and have become very popular worldwide since their introduction in 1999.

Objectives

The technology and benefits of the different generations of SHCLs will be presented and in comparison with previously existing lens materials discussed. The aim is to give an objective view on all soft lens materials available and to offer some advice on the ideal lens choice.

Methods

Based on a literature search and the presenter's own experience, the success of the three generations of SH materials will be discussed.

Do now conventional hydrogel contact lenses belong to the past?

Is extended contact lens wear now safe, due to the 4-5 fold increase in oxygen permeability with SHCLs?

Has the infection rate with regular and extended contact lens wear decreased with SHCLs?

Do contact lens wearers now experience fewer dry eye symptoms?

Results

Due to the 4-5 fold increase in oxygen permeability, extended contact lens wear has become safer with SHCLs. However, there has been some evidence published that the infection rate has not since decreased, but they may occur at a reduced severity. Newer generations of SH materials have lower modulus values and hence cause fewer mechanical staining and prove more comfortable.

Manufacturers have continuously improved the SH surface characteristics in order to mask the hydrophobic silicone; however their wetting characteristics are still problematic for eyes with oily tears. Care has to be taken with the choice of cleaning solutions as their preservatives are readily absorbed by SH materials. Peroxide based solutions represent the gold standard. When multipurpose solutions are used, aftercare appointments 2 hours after lens insertion are recommended, in order to check for staining.

Conclusions

It remains important to address individual needs and expectations, as well as the physiological factors such as tear film quality and corneal parameters. It has become clear that other factors than oxygen permeability are important for the success of contact lens wear. Improvements regarding the biocompatibility of lens materials are still required.



P-test: a new method for predicting dry eye symptoms in new contact lens wearers

Presenter: Paul .J. Murphy¹

Co-Authors: C. Purslow¹, H. Pult^{1,2}

¹School of Optometry and Vision Sciences, Contact Lens and Anterior Eye Research (CLAER), Cardiff University, Cardiff, UK

²Optometry and Vision Research, Weinheim, GERMANY

Background/Purpose

Lid wiper epitheliopathy (LWE) and lid parallel conjunctival folds (LIPCOF) have been shown to give acceptable levels for prediction of dryness symptoms in contact lens wearers. This study investigates whether a combination of LWE and LIPCOF plus other tear film tests and subjective evaluation prior to contact lens fitting, is better able to predict contact lens induced dry eye (CLIDE) symptoms.

Methods

Tear meniscus height (TMH), non-invasive break-up time (NIBUT), hyperaemia, LIPCOF, phenol red thread test (PRTT), corneal and conjunctival staining and lid wiper epitheliopathy (LWE) of the right eyes of 33 new SCL wearers (male = 12, female = 21, median age = 30.5 years; range = 19-44) were assessed in a prospective longitudinal study. Symptoms were evaluated by the Ocular Surface Disease Index (OSDI) and subjects grouped into 20 symptomatics and 13 asymptomatics in later lens wear by the Contact Lens Dry Eye Questionnaire (CLDEQ). Subjects were fitted with Vifilcon A and Senofilcon A lenses for a 2 week period consecutively.

Results

Limbal hyperaemia and LWE changed significantly during the study ($p < 0.004$) but not LIPCOF ($p \geq 0.318$; temporal, nasal and Sum), bulbar hyperaemia ($p = 0.432$), staining ($p \geq 0.060$). Limbal hyperaemia significantly decreased in Senofilcon A lenses. Wearing comfort of symptomatics significantly improved in Senofilcon A, ($p = 0.005$). At the enrolment visit, subjects who became symptomatic later exhibited significantly decreased NIBUT, increased LIPCOF and OSDI ($p < 0.027$). The best test combination to predict CLIDE (logistic regression analyses) was LIPCOF Sum (temporal plus nasal LIPCOF (summarized)) plus NIBUT and OSDI, (positive predictive value = 87.0% and accuracy = 91.0%).

Conclusions

LIPCOF, NIBUT and OSDI are significant discriminators for dry eye symptoms in later contact lens wear, but not hyperaemia, TMH, PRTT, staining and LWE. The best test combination is NIBUT plus LIPCOF Sum and OSDI, named the Pult-Predictive-Test (P-Test).



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4 pillar model for low vision rehabilitation in Upper Austria

Presenter: Peter Gumpelmayer

Co-Author: Alois Stütz

AUSTRIA

Background

In the last 5 years the demographic change in the population lead to an increase of patients with permanent visual impairment. The Upper Austrian Optometric Council (Landesinnung der Augenoptiker Oberösterreich) developed a 4 Pillar system with full area coverage to meet the needs of Low Vision Patients.

Methods

The main aim was to develop a decentralized system with uniform standards.

Part A: was to train the individual optometrist in their role as a Low Vision Specialist.

Part B: to develop uniform, reproducible standards and documentation, especially in the fields of illumination and contrast.

Part C: uniform equipment to be installed in the Low Vision practices.

Part D: Continuous Education and Training for the Low Vision Specialists.

The results of the systems was presented to the provincial government and provincial medical aids and the implementation for the 4 pillar system throughout the province is presented and the conclusions lead to spread of the system into other Austrian provinces.



Low vision: visual acuity, contrast sensitivity and the effect of luminance change

Presenter: A Jonathan Jackson^{1,2}

Co-author: Ian L Bailey¹

¹School of Optometry, University of California, Berkeley, USA

²Dept Opth, Royal Victoria Hospital/Queen's University, Belfast, UK

Background

Low vision practitioners are conscious that visual performance is often dramatically affected by task luminance. Advice on the quality or quantity of lighting, given by clinicians, is typically based on patients' reports of their experiences.

Research Question

Can the impact of luminance changes on visual performance be quantified simply within Low Vision examinations?

Methods

Subjects were recruited from the Low Vision Clinic of the School of Optometry at UC Berkeley. VA measurements were made with a retro illuminated Bailey-Lovie chart at 3 or 4 metres. CS was measured with a computer-based test for detecting large blinking square targets (5 degrees)¹. The test provides a plot of response time as a function of target contrast. VA and CS measurements were made with and without NOIR U23 fit-over grey sunglass filters (ND = 1.8), thus measuring changes in VA and CS in response to a standard reduction (to 1.6%) in retinal illuminance.

Results

Normally sighted subjects (n=18) show, on average, a 0.20 log unit reduction (10 letters) in VA and a 0.12 log unit reduction (25%) in CS. Within low vision patients with the same diagnosis, there is usually considerable diversity. Patients with ARMD (n=23) show considerable variation in both VA (mean loss 0.28 log units, range +5 to -36 letters) and CS (mean loss 0.20 log units, range +0.20 to -0.45 log units). Glaucoma patients (n=9) show approximately the same reduction in VA as normals (0.23 log units) but more than twice the reduction in CS (0.28), RP patients (n=7) show even more pronounced reductions in both visual functions VA (0.32) CS (0.42). Patients with albinism generally show little change in acuity but moderate reductions in CS. Persons with achromatopsia consistently show improved CS with low luminance.

Conclusions

Low vision patient responses to reductions in illumination can be easily characterized quantitatively by measuring VA and CS with and without a standard dense neutral filter. Such information can guide decision making by the low vision clinician.

References

1. IL Bailey, AJ Jackson, J Zwilling, RB Greer
Quantifying the effect of illumination on visual acuity and contrast sensitivity in low vision patients
ARVO abstract 2008 Vol 49 E-Abstract 1510



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Development of the Cardiff Visual Impairment Ability Questionnaire for children and young people (CVI AQC)

Presenter: Jyoti Khadka

Co-authors: J.M. Woodhouse, B. Ryan, T. Margrain

School of Optometry and Vision Sciences, Cardiff University, Cardiff, UK

Purpose

Our aim was to develop an instrument to measure vision specific ability in children and young people with visual impairment. Such a tool would be useful to assess efficacy of rehabilitative interventions in this demographic.

Methods

89 items on a six scale response category were developed from 13 focus groups conducted with children and young people with and without a visual impairment. The 89 item instrument was piloted on 45 visually impaired children and young people (64% boys; mean age, 12.7+/- 3.5 yrs; median, 13 yrs) using face to face interviews. All participants were between 5 and 18 years of age, verbally communicating and had some vision. Ethical approval was obtained and parental and individual consent were obtained prior to an interview. Rasch analysis was used to analyse the response category function and to facilitate item removal whilst ensuring a valid unidimensional scale.

Results

64 items were removed primarily on the basis of infit statistics, outfit statistics and/ or missing data. The final 25-item Cardiff Visual Ability Questionnaire for children and young people (CVI AQC) had good infit and outfit values (infit: 0.80-1.18, outfit: 0.83-1.25), good person and item separation (>2) and high person and item reliability coefficients (0.82 and 0.94 respectively). Rasch analysis identified disordered category thresholds and under utilization of the end-response category. Therefore, categories were merged to a four-response option.

Conclusions

All the items on the 25 item, 4 response category CVAQC work together to form a unidimensional scale for the assessment of efficacy of rehabilitative interventions on children and young people with visual impairment.



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The use of Fluorescein in contact lens aftercare across Europe

Presenter: Ian P Davies

The Vision Care Institute of Johnson & Johnson Medical Ltd, UK

Background

Sodium Fluorescein has been used to assess corneal lesions for over 100 years and is used to day in almost all spheres of contact lens practice. In soft contact lens aftercare its primary use is to assess the integrity of the corneal and conjunctival surface and it is widely considered to be an essential tool in the identification and differential diagnosis of many corneal and conjunctival changes. Most recently its use has achieved prominence in the assessment of the cornea with different combinations of contact lens care products and materials.

Research Objectives

To assess the use of Fluorescein staining amongst eyecare practitioners across 5 European countries in routine contact lens practice.

Method

Between July 2006 and March 2008 2,116 contact lens fitting eye care practitioners were surveyed on their use of Fluorescein in routine contact lens aftercare and their perception of the incidence of corneal staining. Results were collected using an interactive voting system and following the presentation of the results discussions were held on the reasons for the responses.

Results

Significant differences were found in the responses from practitioners from around the region with the UK being the only group in which over 50% of practitioners claimed to use Fluorescein at every visit. Not surprisingly the countries that used the most Fluorescein also reported the highest perceived incidence of corneal staining. The 2 reasons given most for not using Fluorescein more were a concern about damage to the lenses and a fear of secondary infection.

Conclusions

The lack of wide spread routine use of Fluorescein in this cohort of practitioner is a concern and is likely to be mirrored across the countries in which they practice. The reasons given for not using the dye more are rooted in old beliefs about its interaction with lenses and the eye. This study shows the need for accurate and regularly updated education to be an essential part of the contact lens practice.



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Using Objective Structured Clinical Examinations (OSCE) to document student clinical skills from year 1 to year 2

Presenter: Yvonne Norgett

Co-authors: John Siderov & Rupal Lovell-Patel

Anglia Vision Research, Department of Optometry and Ophthalmic Dispensing, Anglia Ruskin University, Cambridge, UK

Yvonne.norgett@anglia.ac.uk

Background and aim

OSCEs are valid and reliable forms of assessment of clinical skills and competency. We used OSCEs in the first and second years of our optometry course to assess clinical optometric skills. The aim was to evaluate whether student performance on OSCEs could be used to measure improvement in optometric skills from Year 1 to Year 2.

Methods

Five 10-minute OSCE stations were created: case history, ophthalmoscopy, retinoscopy, subjective refraction and ocular motor balance. A checklist marking scheme was produced for each station incorporating a performance based standard setting procedure. Separate station checklists were created for each year of assessment, reflecting the different expectations from Year 1 to Year 2. For each station, examiners completed the checklist and made a global judgment about each student's performance using a rating scale, (bad fail, fail, borderline, pass, good pass). The same class of (34) optometry students was assessed during the first and second years of their course.

Results

Repeated measures ANOVA revealed a significant interaction between year and OSCE station ($p < 0.01$). Average marks were higher on the retinoscopy and ophthalmoscopy stations in Year 1 compared to Year 2. Performance across years for the other 3 stations was not significantly different. For each station and student, global rating was plotted against checklist scores and fit with a linear regression to determine the pass mark (using the borderline rating). Only the Year 1 pass marks for retinoscopy and ophthalmoscopy stations were higher than Year 2. Pearson's product correlations were not significant for any Year 1 to Year 2 comparison on any station.

Conclusion

Clinical skills in case history, subjective refraction and ocular motor balance improved from Year 1 to Year 2 as the average and pass marks for these stations were not different across years but the expectations had increased. Marks for the retinoscopy and ophthalmoscopy stations were better in Year 1 than Year 2, probably reflecting higher expectations in Year 2 and relatively poorer performance on these stations. The lack of any significant correlation makes predictions about individual student performance from Year 1 to Year 2 difficult.



The repeatability of tear ferning test in healthy subjects

Presenter: Ali Masmali^{1,2}

Co-Authors: Dr. Christine Purslow¹, Dr. Paul Murphy¹

¹School of Optometry & Vision Sciences, Cardiff University, Cardiff, UK

²Optometry Department, School of Applied Medical Sciences, King Saud University, Riyadh, SAUDI ARABIA

Background

Tear ferning (TF) test has been described as a simple clinical test to evaluate the tear film, useful in the diagnosis of dry eye. TF relies on using microscope to observe the crystallisation patterns produced by drying a tear sample on a clean microscope slide.

Purpose

To assess the repeatability (within and between sessions) of the TF patterns obtained from collected tear samples amongst normal subjects.

Methods

16 healthy subjects (11 male, 5 female; mean age 28.8 ± 5.1 yrs) were assessed by non-invasive tear break-up time (NIBUT), slit-lamp and completed the symptomatic questionnaire (McMonnies dry eye questionnaire) for exclusion purposes. Stimulated tear samples were collected from the lower tear meniscus of left eyes using glass capillaries during three sessions;

1. 5 separate samples (5 x 10 μ l) in one morning session;
2. on a second day a 10 μ l sample was obtained at a morning session (8:30-9:30am);
3. a further 10 μ l sample was collected the same afternoon (3:30-4:30pm).

From each sample, 5 x 1 μ l drops were pipetted and dried onto glass slides under controlled room temperature and humidity conditions, then observed using digital microscopy (10x magnification). TF patterns were observed and classified according to Rolando's grading scales.

Results

In session 1, no significant difference was found between the five separate samples (Friedman Test, $p > 0.05$). TF patterns produced were Type I (38%), Type II (57%) and Type III (5%). There were no Type IV patterns. There was also no significant difference between the TF patterns for the five drops produced for each sample (Friedman Test, $p > 0.05$). 69% of subjects produced identical ferning patterns in all 5 drops: Type I in 36.4% and Type II in 63.6%. Between sessions, no significant differences were found (Friedman Test, $p > 0.05$).

Conclusions

Type II is most commonly observed in young, healthy subjects, and a single sample appears to be representative of a patient. Time of day for collection of sample appears to have little influence on the TF pattern observed. The TF test is still a relatively uncommon test, but has potential for clinical and research use as protocols and quantification methods are further developed.



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Visual stress clinic at Anglia Ruskin optometry clinic – 2 year audit

Presenter: Rupal Lovell-Patel

Myopia and Visual Function group, Postgraduate Medical Institute, Department of Optometry and Ophthalmic Dispensing, Anglia Ruskin University, Cambridge, UK

Introduction

The visual stress clinic was established in 2006 to bridge the gap in the provision of optometric-led treatment to patients suffering from visual stress in Cambridge. It was also to provide additional binocular vision experience for optometry undergraduate students.

Background

At the end of the 2 years, the clinic underwent an evaluation to understand whether it was successfully in meeting its objectives and that any further expansion would be sustainable. Patients were required to use the coloured overlays for 3 months and show an increase in the rate of reading of $\geq 8\%$ before colour therapy was considered beneficial. After this period they could carry on using the overlays or be assessed to use precision tinted spectacle lenses.

Results

56 patients had been seen in the clinic at the time of the audit. 62% of the patients had been diagnosed as dyslexic, 4% autistic, and 2% suffering from anxiety disorder, whilst 32% had not been diagnosed with any specific learning difficulties but felt the symptoms they experienced during near-work were not alleviated by using spectacles. The mean age of the patients seen was 21 years. 47% of patients were hyperopic, 18% myopic with 35% did not require spectacles. 19% of the patients were found to have binocular vision problems and were given exercises or prescribed prisms. 91% of the patients found the coloured tint therapy beneficial (average rate of reading increase of 10%). 29 patients had not tried coloured tint therapy before and of these patients 52% decided to carry on using overlays after the initial 3 month use rather than move to precision tinted spectacle lenses. 71% of patients who wanted the precision tinted spectacle lenses selected a similar hue to the overlay.

Conclusion

Patients coming to the clinic needed optometric interventions as well as coloured lens therapy. The clinic is unique in that most of the patients seen are older and there is little published work available. Recent studies average ages have been 10yrs or 14yrs (Scott et.al, 2002 and Evans et.al, 1999). It is providing a specialist service to the population of Cambridge as well as supplementing the binocular vision experience of the undergraduate students.

References

1. Lorna Scott, Hazel McWhinnie, Lynette Taylor, Nicola Stevenson, Peter Irons, Elizabeth Lewis, Marylyn Evans, Bruce Evans, Arnold Wilkins. 2002. Coloured overlays in schools: orthoptic and optometric findings *Ophthalmic and Physiological Optics* Vol 22 (2), Pages:156-165.
2. Bruce J.W. Evans, Ragini Patel, Arnold J. Wilkins, Anita Lightstone, Frank Eperjesi, Lynne Speedwell, John Duffy. 1999. A review of the management of 323 consecutive patients seen in a specific learning difficulties clinic. *Ophthalmic and Physiological Optics*. Vol 19(6), Pages:454-466



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Differences in accommodative facility in myopes corrected with contact lenses and spectacles

Presenter: Ebi Osuobeni

Co-Authors: Husam Elkassem & John Siderov

Anglia Vision Research, Department of Optometry and Ophthalmic Dispensing, Anglia Ruskin University, Cambridge, UK

Background and aim

Accommodative facility is the rate at which accommodation is stimulated and inhibited within a specified period of time. Myopes have reduced accommodative facility at far test distances. Use of contact lens optical correction has been shown to adversely affect accommodative ability. Therefore, the aim of this study was to determine the effect of the mode of optical correction (spectacle lens, SPX vs. contact lens, CL) on measured accommodative facility in myopes.

Methods

Fifteen adult subjects with at least -4.00D spherical equivalent and astigmatism of less than 1.00DC participated in the study. A full refraction and contact lens fitting was performed for each subject. Accommodative response to lenses was measured using an open-field autorefractor. Binocular accommodative facility was measured using flipper lenses (plano/-2.00D) at far (6m) and near ($\pm 2.00D$) (50cm) test distances. Suppression was monitored. Subjects cleared a high contrast N5 target at near and a 6/9 target at distance while viewing through the flipper lenses. An examiner flipped the lenses according to the subject's responses. The flip rate was recorded via a custom programme.

Results

Amplitude of accommodation was significantly greater through SPX than CL ($p = 0.000$). The average response to the 2.00D accommodative step at far through CL was $1.50 \pm 0.88D$. The corresponding value through SPX was $1.32 \pm 0.75D$. The difference between the means was not significant ($p = 0.67$).

The difference between the mean far accommodative facilities (CL-SPX) was -2.77 ± 3.58 cpm. This difference was significant ($p = 0.009$). There was a corresponding significant increase in the far positive response time when myopes were corrected with contact lenses ($p = 0.028$). The mode of correction did not significantly affect facility at near ($p = 0.262$).

Conclusions

Myopes accommodate more through CL than SPX and the amplitude of accommodation measured through CL is lower than SPX for myopes. Myopes have lower far accommodative facility when measured through CL than SPX. The reason for the difference is because myopes have slower positive response time through CL than SPX.



Comparing measurement of associated phoria using the near Mallett unit and the Saladin card

Presenter: Saud Alanazi^{1,2}

Co-Authors: C. Purslow¹, R.V. North¹, F. Ennis¹

¹School of Optometry & Vision Sciences, Cardiff University, Maindy Road, Cardiff, UK

²King Saud University, Riyadh, SAUDI ARABIA

Background/Aim

Associated phoria (AP) can be an important aspect of binocular vision assessment, but measurements are variable from one test to another (e.g. Mallett unit, Sheedy disparometer) in the clinical setting. Hence validity and repeatability studies are required. The Mallett Unit is commonly used in the UK, but the Saladin card has the advantage of being an inexpensive, lightweight and portable facility, making it particularly useful in non-traditional optometric settings such as in schools & nursing homes. The purpose of this study was to compare AP as recorded by the Near Mallett Unit (NMU) and the Saladin card (SC), and to assess the repeatability of both.

Methods

Ninety-three normal subjects (mean age: 22 ± 4.3 years) were recruited who met inclusion criteria of: monocular VAs of 0.1 or better, absence of asthenopic symptoms; ortho or low heterophoria (5 eso to 7 exo distance, 4 eso to 10 exo near) and 60" or better stereoacuity. APs were measured using the NMU and SC placed at eye level at 40 cm at 300 lux background illumination. Thirty-two subjects (mean age: 23.1 ± 4.45 years) repeated the tests after an interval of one week. All subjects provided written informed consent and this study conformed to the tenets of the Helsinki declaration.

Results

The mean AP with the NMU was -0.086 ± 0.503 and with the SC was -0.096 ± 0.49 (mean \pm SD) with no statistically significant difference between the two techniques ($p > 0.05$). The mean difference in AP between the two techniques was 0.011 ± 0.59 (95% limits of agreement -0.1125 and 0.134). The inter-session repeatability indices for the two techniques did not differ significantly ($p > 0.05$), the mean difference being 0.063 ± 0.35 (mean \pm SD, 95% limits of agreement of -0.065 and $+0.19$).

Conclusions

The Saladin card and Mallett unit appear to give similar measures and repeatability level for assessment of AP in a clinical setting.



A comparison of lens crystallin distributions in two species of tree-frogs

Presenter: Jonathan Keenan¹

Co-Authors: Giuliano Elia², Michael J Dunn³, David F Orr¹ and Barbara K Pierscionek¹

¹Vision Science Research Group, School of Biomedical Sciences, University of Ulster, Northern Ireland, UK

²Mass Spectrometry Resource, UCD Conway Institute of Biomolecular and Biomedical Research, University College Dublin, Dublin, IRELAND

³Proteome Research Centre, UCD Conway Institute of Biomolecular and Biomedical Research, School of Medicine and Medical Sciences, University College Dublin, Dublin, IRELAND

Background

The eye lens remains transparent on account of soluble lens proteins known as crystallins. For many years α -crystallins have been known as the main lens proteins in lower vertebrates such as fish and amphibians¹. More recently taxon-specific β - and γ -crystallins have been identified in frog lenses^{2,3}. The function of these proteins has not yet been determined. Because of the unique growth features of the lens it is an ideal structure to study from an ageing viewpoint. Few studies have examined such changes in anuran lenses in the past.

Aims and Objectives

This study aims to investigate protein distribution patterns in tree-frog lenses and determine if inter-species differences exist. We also aim to investigate whether taxon-specific lens crystallins are present in these species.

Methods

Eye lenses obtained from *Litoria infrafrenata* and *Phyllomedusa sauvagii* frogs were fractionated into 8-9 concentric fractions by controlled dissolution using a technique previously applied to bovine and porcine lenses^{4,5}. Water-soluble proteins from all layers were separated into HMW, MMW and LMW fractions by size-exclusion HPLC and constituents of each protein class revealed by SDS gel electrophoresis. Protein proportions were calculated using integration and Bradford assay. Size-exclusion HPLC fractions were further analysed by LTQ linear IT mass spectrometry.

Results

Similar HPLC elution profiles were achieved from both species studied. Each of the common crystallins were present in outer lens layers with the most prominent of these being α -crystallins. Towards the lens centre there was a decrease in the proportion of α - and β -crystallins and an increase in the proportions of γ -crystallins and insoluble proteins. The only soluble proteins detectable in inner layers were γ -crystallins. From MS/MS analysis, bands corresponding to A-, BA1-1-, BB2- and II-crystallins were identified with the highest sequence identity seen with *Rana catesbeiana* lens proteins on the whole.

Conclusions

As in other amphibians, the major lens crystallin in *Litoria* and *Phyllomedusa* lenses is α -crystallin. This study has shown that taxon-specific lens crystallins are not present in all tree-frog species. Further work is needed to determine exactly which amphibians have taxon-specific crystallins, what their evolutionary origins may be and what function they perform.

References

1. Brahma SK, van Doorenmaalen WJ (1969) Study of the soluble lens proteins from different amphibian species. *Exp Eye Res* 8: 168-171
2. Tomarev (1984) Tomarev SI, Zinovieva RD, Dolgilevich SM, Luchin SV, Krayev AS, Skryabin KG, Gause Jr GG (1984) A novel type of crystallin in the frog eye lens. 35-kDa polypeptide is not homologous to any of the major classes of lens crystallins. *FEBS Lett* 171(2): 297-302
3. Fujii Y, Kimoto H, Ishikawa K, Watanabe K, Yokota Y, Nakai N, Taketo A (2001) Taxon-specific ζ -crystallin in Japanese tree frog (*Hyla japonica*) lens. *J Biol Chem* 276(30): 28134-28139
4. Pierscionek B, Augusteyn RC (1988) Protein distribution patterns in concentric layers from single bovine lenses: changes with development and ageing. *Curr Eye Res* 7(1): 11-23
5. Keenan J, Orr DF, Pierscionek BK (2008) Patterns of crystallin distribution in porcine eye lenses. *Mol Vis* 14: 1245-1253



The content matters: the influence of cognition on accommodation and pupil size in reading

Presenter: Matjaž Mihel i¹

Advisor: Jane Gwiazda²

¹SLOVENIA

²New England College of Optometry, Boston, USA

Purpose

The reading of texts associated with intensive mental activity causes physiological mydriasis due to extra sympathetic arousal. Larger pupils in this case, as well as every other suboptimal ocular response, are believed to be a factor in near-point stress. In the present study the relationship of the pupil size changes and lag of accommodation during reading of texts with varying cognitive demand was examined to determine whether the content of reading has significant influence on the accommodative and pupillary response. The results are discussed in regard to possible impact on myopia growth.

Methods

The study included 112 high school students (84 female, 28 male) aged 17 to 19. At the distance of 40 cm (=2.5 D) five short texts with different cognitive demands were presented on a laptop screen. Contents were: random word reading (1), the reading of a text with no sense (2), a philosophical, novel-like text (3), calculation of short equations with a positive result (4) and calculation of short equations with a negative result (5). From 1.0 m distance, the measurements of pupil size and accommodation were taken using the Plusoptix Power Refractor. The lines with test content were placed in the very upper rows of the screen and had a width of 10 cm to minimize eccentricity of measurements. The measurements were made with habitual correction in place. The minimal monocular VA required was 20/22. All anisometropes (over 1.0 D of difference in sph. equivalent OD-OS), higher ametropes (over ± 5.0 D), strabismic and amblyopic subjects were excluded despite appropriate correction.

Results

Accommodative lag was found to be very stable during all the tests, with the mean value of 0.275 D. On the other hand, the pupil size varied significantly, depending on the mental effort and type of cognitive involvement. Although smallest pupils and lags were expected in the random word reading test, which represents the minimum cognitive effort in reading, they were just in the average range here (5.01 mm). Smallest pupils were associated with the reading of advanced philosophically blended texts (4.79 mm), whereas texts with simple calculations were associated with greatest pupil size (5.08 mm).

The difference between these two was statistically significant with $p = 0.0024$. Average pupil size overall was 4.97 mm. Separately a group of 62 subjects, which were categorized also according to the type of their personality, scientific vs. humanistic, was analysed. The scientific group showed significantly larger lags of accommodation and notably smaller pupils in all five tests. The mean value of ametropia in these two groups did not differ significantly.

Conclusions

The results show that the pupil size does not solely depend on the extent of cognitive involvement in reading but also on the type of cognition. According to this study, young subjects reading contents with higher cognitive demand, particularly those that require instant reasoning, have larger pupils than subjects reading philosophical novel-like texts. Larger pupils are associated with more exaggerated aberrations and smaller depth of focus. With consistent lag of accommodation, retinal image in this case must be blurrier or at least closer to the blur point. Considering accommodative micro fluctuations, whose amplitudes were reported to be just in the range of the accommodative lag measured in this study, it can be concluded that the content of reading itself is a factor in near-point stress and could hypothetically contribute to myopia growth.



The European Academy
of Optometry and Optics

42 Craven Street, London, WC2N 5NG, United Kingdom

Telephone: + 44 (0) 20 7766 4345 **Fax:** + 44 (0) 20 7839 6800

E-mail: info@eao.info **Web:** www.eao.info