



European Academy  
of Optometry and Optics

# Programme and Abstracts Booklet

**European Academy 2012 Dublin**  
Friday 20 – Sunday 22 April



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Diane Wallace  
Professor Abbas Yekta

## Welcome from the President



It is my great pleasure to welcome you to Dublin for the Academy's fourth annual conference.

This is my first conference as Academy President and I am delighted that we are able to offer an even bigger programme than last year, once again covering the three themes of education, research and clinical practice. With representation from over 25 different countries, the event promises to be another real opportunity to discuss ideas from all corners of Europe and the wider world.

Our keynote lectures this year come from Professor Pablo Artal (University of Murcia, Spain), on adaptive optics and new research in the field, and Dr Kathryn Saunders (University of Ulster, Coleraine, UK) covering clinical practice in relation to paediatric care. As usual, though, there is much more to the conference, with oral presentations, clinical workshops, discussion forums, case study sessions, members' special interest groups and a record number of posters on display throughout the event. Poster presenters will be available to discuss their work with you during the lunch sessions, so get your questions ready!

As this programme booklet demonstrates, the interest amongst European eye care professionals to come together to share and learn is very strong. The Academy is proud to be providing that opportunity, but we still need your help to grow. As well as bringing together the leaders of the profession all over Europe, people like you, we also need to engage with those who are not yet aware of what the Academy is doing and what it can offer them. With nearly 350 members from 34 countries, the Academy has already established an important network that is crossing national boundaries in Europe, but with your help we can offer even more to everyone.

Finally, I would like to thank our conference sponsor, Essilor, as well as our Academy sponsors Johnson & Johnson, Vision Care and Alcon for their much valued support and the Association of Optometrists Ireland for being our hosts this year.

I hope you enjoy the conference and the many presentations available throughout the weekend. I look forward to meeting many of you for the first time, and do remember to complete your feedback form so that we can make the fifth conference even better.

A handwritten signature in black ink, appearing to read 'R. Crelier'. The signature is fluid and cursive, written on a white background.

**Professor Roger Crelier**

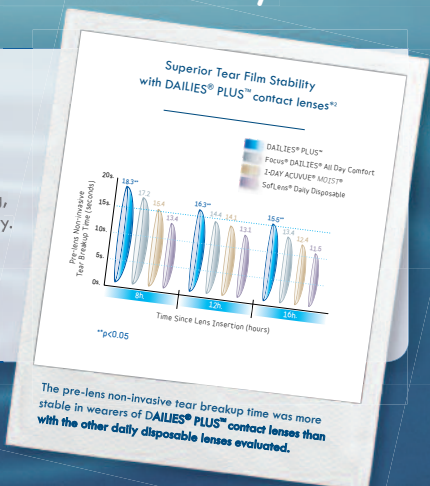
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 Important information for AIR OPTIX® AQUA (torafalcon B) and AIR OPTIX® AQUA MULTIFOCAL (torafalcon B) contact lenses: For daily wear or extended wear up to 6 nights as determined by an eye care professional for near/far-sightedness and/or presbyopia. AIR OPTIX® NIGHT & DAY® AQUA (torafalcon A) contact lenses: For daily wear or extended wear up to 30 nights as determined by an eye care professional. AIR OPTIX® for ASTIGMATISM (torafalcon B) contact lenses: For daily wear. Risk of serious eye problems (i.e., corneal ulcer) is greater for extended wear. In rare cases, loss of vision may result. Side effects like discomfort, mild burning or stinging may occur.  
 References: 1. Wolffsohn J, Hunt O, Chowdhury A. Objective clinical performance of 'comfort enhanced' daily disposable soft contact lenses. Contact Lens and Anterior Eye. 2010; 33: 88-92. 2. Based on a post-launch evaluation in which 88 eye care professionals refit 444 contact lens wearers in AIR OPTIX® AQUA lenses; CIBA VISION data on file, 2011.  
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## Alcon and CIBA VISION Together As One

Dear Colleagues,

As one of the main sponsors of the European Academy of Optometry and Optics (EAOO), we are delighted to welcome you to the 2012 Annual Conference. This is an important event in the eye care industry and we are very pleased to support this key educational meeting in line with our long-standing commitment to continuous education and support for you and your staff.

We would also like to take this opportunity to remind you that CIBA VISION is now Alcon. By combining Alcon, CIBA VISION and Novartis Ophthalmics into one global eye care business, Alcon now offers the broadest spectrum of surgical, pharmaceutical and vision care products in the ophthalmic industry. Building on our decades of experience, Alcon is committed to advancing innovations in eye care, and pioneering uncharted territories to address unmet patient needs.

Over the next five years, Alcon plans to invest approximately USD 5 billion to discover and develop innovative treatments for vision conditions and eye diseases. This represents the largest commitment to R&D in the eye care industry. Alcon is currently developing products to treat cataracts, glaucoma, age-related macular degeneration, retinal diseases, dry eye, infections, inflammation, ocular allergies, refractive errors and other ocular health issues.

Through the integration of CIBA VISION, Alcon is now one of the largest manufacturers of contact lenses and lens care products. The Alcon contact lens product portfolio includes the AIR OPTIX® brand of breathable contact lenses with innovative TriComfort™ Technology, DAILIES® disposable contact lenses, and FreshLook® colored lenses. Products within the Alcon contact lens care portfolio include OPTI- FREE® multi-purpose solutions, which clean, rinse and disinfect contact lenses, as well as the hydrogen peroxide-based AO Sept Plus® cleaning and disinfecting solution.

While we are moving forward with the integration of CIBA VISION into the Alcon Vision Care Business, we are also uniting CIBA VISION and Alcon names under one corporate brand – Alcon. Together we are now one company and one Alcon, working to shape the future in eye care and to complete our mission to provide innovative products that enhance quality of life by helping people see better.

We wish you a successful and inspiring conference and we look forward to continue working with you, now with a reinforced team!

Best regards,

**Vision Care Team, Alcon EURMEA**

# European Academy 2012 Dublin

## Shaping optometry and optics in Europe

**This year's European Academy annual conference in Dublin offers delegates the opportunity to discuss and debate key issues, to interact with colleagues from around the world and to learn from each other.**

The conference brings together practitioners, educators, researchers and administrators from across Europe. It offers many different ways to learn, share ideas and network: lectures; poster presentations; clinical and educational workshops; clinical case study sessions; national education development sessions; and roundtable discussions for Academy members. It also offers a forum for networking and discussion in an environment which facilitates collaborations and partnerships.

The Academy is hosting the welcome reception with the American Academy of Optometry (AAO), and the members' annual gala dinner with the Association of Optometrists Ireland (AOI). Thanks to both organisations for their support for this exciting event.

### Conference aims:

- To enhance communication and cooperation among educational institutions
- To support the harmonisation of optometry and optics across Europe
- To promote education, research and scientific knowledge in optometry and optics
- To promote collaborative working
- To facilitate the building of European networks that cross borders and languages

### Conference sessions

**Clinical Workshops.** Five workshops will be held at the Dublin Institute of Technology and will support the development of practical skills.

**Poster Presentations.** Over 70 posters will explore a range of topics, giving delegates the opportunity to gain valuable insights and develop their personal networks.

**Presentations.** Leading researchers and academics will focus on the latest developments

in eye health care. The conference also features two keynote lectures.

**Discussion Forums.** These forums will explore the major issues facing the practice and development of optometry and optics across Europe. These sessions are designed to be interactive and all delegates are encouraged to participate.

**Case Studies.** These sessions will bring together three or four brief case studies for discussion, allowing delegates to share and compare practice. Facilitated by a Chair, the sessions will allow delegates to discuss how they work, and to explore how they can learn from each other.

### Members' Special Interest Groups.

These sessions offer members the opportunity to develop their professional networks in the areas of: cornea, contact lenses and refractive technology; optometric low vision rehabilitation; binocular vision; primary eye care; and optometric education. These sessions are exclusive to Academy members.

### What is the European Academy?

The Academy is a membership organisation that is working to provide a much needed voice to help advance the profession, develop the scientific knowledge base and support and promote lifelong learning for optometrists, opticians, vision scientists and all those involved in eye health care across Europe. In doing this, we are changing the face of optometry and optics in Europe by engaging, educating, inspiring and motivating our educators, students, researchers and practitioners.

### Get involved

The practice of eye care is changing. Become a member of the Academy and help shape optometry and optics in Europe. Come and talk to us at the registration desk at the Croke Park Conference Centre or find us online at [www.eaoo.info/membership](http://www.eaoo.info/membership).

# Academy Schedule

The Academy has applied to the UK's General Optical Council (GOC) for continuing education points (CE) for some sessions. This colour coded key will help you identify which sessions have points applied for:

- Optometrists
- Dispensing Opticians
- Contact Lens




Day 1		Dublin Institute of Technology	
Friday 20 April	13.00 - 18.00	<p><b>Clinical Workshops.</b> Register at Croke Park Conference Centre at 13.00. Bus transportation provided to and from the Dublin Institute of Technology (DIT), returning at 18.00.</p> <p><b>Detection and management of lid margin disease,</b> Caroline Christie <span style="color: #000080;">○</span> <span style="color: #000080;">CL</span></p> <p><b>Slit lamp ophthalmoscopy,</b> Dr Holger Dietze <span style="color: #000080;">○</span></p> <p><b>Fitting RGP scleral contact lenses on patients with distorted corneas,</b> Philip Fine <span style="color: #000080;">○</span> <span style="color: #000080;">CL</span></p> <p><b>Checking and dispensing prisms,</b> Patricia Mordaunt <span style="color: #000080;">○</span> <span style="color: #FFA500;">DO</span></p> <p><b>Optomap workshop,</b> Anne Salmon <span style="color: #000080;">○</span></p>	Breakout Room 2
	18.00 - 19.00	<p><b>Welcome reception at Croke Park Stadium.</b> Hosted by the European Academy of Optometry and Optics (EAOO) and the American Academy of Optometry (AAO).</p>	
Day 2		Croke Park – Hogan Suite	
	07.30 – 08.00	Conference registration and refreshments	
	08.00 – 09.00		
	09.00 – 10.00	<p><b>European Council of Optometry and Optics General Assembly</b> (open to Academy delegates to attend as observers)</p>	Discussion Forum 1
	10.00 – 11.00		Discussion Forum 2
	11.00 – 12.00		Discussion Forum 4
	11.00 – 12.00		Discussion Forum 5
	12.00 – 13.00	Lunch	
Saturday 21 April			
	13.00 – 13.45	<b>Academy AGM (members only) and election results</b>	
	14.00 – 14.20	<b>Academy opening address and presentation of EAOO Fellows</b>	
	14.20 – 15.20	<b>Keynote 1:</b> Professor Pablo Artal. <i>Adaptive optics with a focus on new research</i> <span style="color: #000080;">○</span>	
	15.20 – 15.45	Coffee break and poster sessions	
	15.45 – 16.45	<b>Academic &amp; Research 1</b> <span style="color: #000080;">○</span> <span style="color: #FFA500;">DO</span>	Members' Special Interest Group 1
	16.45 – 17.45	<b>Presentation: The European Diploma</b>	Academic & Research 2
	19.30 – late	<b>Annual Academy Dinner at Croke Park Stadium in collaboration with Association of Optometrists Ireland</b>	
Day 3		Croke Park – Hogan Suite	
	08.00 – 09.00		Breakout Room 2
	09.00 – 10.00	<b>Academic &amp; Research 3</b>	Members' Special Interest Group 2
	10.00 – 10.30	Coffee break and poster sessions	Members' Special Interest Group 3
	10.30 – 11.30	<b>Academic &amp; Research 4</b> <span style="color: #000080;">○</span>	Members' Special Interest Group 4
	11.30 – 12.30	<b>Academic &amp; Research 5</b> <span style="color: #000080;">○</span>	Members' Special Interest Group 5
	12.30 – 13.30	<b>Keynote 2:</b> Dr Kathryn Saunders. <i>Clinical practice in relation to paediatric care.</i> <span style="color: #000080;">○</span>	
	13.30 – 13.45	<b>Closing address</b>	
	13.45 – 14.30	Lunch	
Sunday 22 April			

Friday 20 April						
Time	Session type	Presenter	Title	Research	Education	Clinical
		Caroline Christie	Detection and management of lid margin disease	o cl		Room / Venue
		Dr Holger Dietze	Slit lamp ophthalmoscopy	o		DIT
13.00 – 18.00	Clinical Workshops	Philip Fine	Fitting RGP scleral contact lenses on patients with distorted corneas	o cl		DIT
		Patricia Mordaunt	Checking and dispensing prisms	o oo		DIT
		Anne Salmon	Optomap workshop	o		DIT
Saturday 21 April						
Time	Session type	Presenter	Title	Room / Venue		
07.30 - 08.00	Registration and refreshments					
08.00 – 09.00	Discussion Forum 1	Judith Morris	RGP lens teaching in educational institutes across the EU		Breakout Room 1	
09.00 – 12.00	ECOO General Assembly	(open to Academy delegates to attend as observers)			Hogan Suite	
09.00 – 10.00	Discussion Forum 2	Professor John Lawrenson	Can questionnaires predict the clinical performance of optometrists in glaucoma detection?		Breakout Room 1	
	Discussion Forum 3	Helmer Schweizer	Communication – a necessity and a success factor in the optometric practice		Breakout Room 2	
	Discussion Forum 4	Dr Annemieke Coops	The effect of legislation on optometric practice: an illustration from the Netherlands		Breakout Room 1	
10.00 – 11.00	Case Study 1	Catrina Barrett	Integrating optometry into primary care		Breakout Room 2	
		Pamela Anketell	Parental and professional views regarding eye care services for children with autistic spectrum disorder			
		Dr Marie Bodack	Clinical characteristics of paediatric patients with exotropia			
11.00 – 12.00	Discussion Forum 5	Professor Roger Kamen	Creating uniformity and high level scope of optometric practice in the US: the importance of standardisation of optometric education		Breakout Room 1	
12.00 – 13.00	Case Study 2	Dr Langis Michaud	Contact lens options for patients with atopic kerato-conjunctivitis		Breakout Room 2	
	Lunch					




## Saturday 21 April

Research Education Clinical

Time	Session type	Presenter	Title	Room / Venue
13.00 – 13.45	<b>Academy AGM</b> (members only) and election results			Hogan Suite
14.00 – 14.20	<b>Academy opening address and presentation of EAOO Fellows</b>			Hogan Suite
14.20 – 15.20	<b>Keynote Lecture 1</b> 	<b>Professor Pablo Artal</b>	Adaptive optics with a focus on new research	Hogan Suite
15.20 – 15.45	Coffee break and poster session			
15.45 – 16.45	<b>Academic and Research 1</b>  	<b>Karen Breslin</b>	Risk factors for childhood myopia: the NICER study	Hogan Suite
		<b>Dr Julie-Anne Little</b>	The relationship between optical factors on accommodative responses in children with Down's syndrome	
		<b>Professor Karla Zadnik</b>	Myopia onset prediction in school children	
		<b>Dr Lisa O'Donoghue</b>	Astigmatism in childhood: The NICER study	
	<b>Members' Special Interest Group 1</b>		Cornea, contact lenses and refractive technology	Breakout Room 1
16.45 – 17.45	<b>Academic and Research 2</b>	<b>Dr Robert Chappell and Dr Adrian Jennings</b>	The European Diploma: an accreditation scheme for European optometry	Hogan Suite
		<b>Claire McDonnell</b>	Does participation in postgraduate education change the way optometrists practise?	Breakout Room 2
		<b>Dr Kaarina Piriä</b>	Optometry students' learning outcomes when e-learning a professional optometry course	
		<b>Dr Imran Khan</b>	Evaluation: a framework for optometric education and practice	
19.30 – late	<b>Academy dinner in collaboration with the Association of Optometrists Ireland (AOI)</b>	<b>Stephen Thompson</b>	Addressing uncorrected refractive error: through human resource development: the current situation in Mozambique compared to VISION 2020 targets	

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 Optometrists

 Dispensing Opticians

 Contact Lens


<b>Sunday 22 April</b>							
Time	Session type	Presenter	Title	Room / Venue			
				Research	Clinical		
08.00 - 09.00	Members' Special Interest Group 2	Richard Corkin	Optometric low vision rehabilitation	Education	Breakout Room 1		
			Academic and Research 3	Keraflex: a new thermal procedure for the treatment of keratoconus	Education	Hogan Suite	
				Aoife Lloyd	The impact of soft contact lens wear on corneal curvature and thickness and on the outcomes of refractive LASER surgery		Hogan Suite
				Philip Fine	Scleral contact lenses improve visual acuity and contact lens tolerance in keratoconus patients		
09.00 – 10.00	Members' Special Interest Group 3	Dr Keziah Latham	Factors associated with adjustment to visual loss		Hogan Suite		
		Professor Greg Black	Binocular vision		Breakout Room 1		
10.00 – 10.30	Case Study 3	Professor Greg Black	3-D optic nerve head interpretations		Breakout Room 2		
		Coffee break and poster session					
10.30 – 11.30	Academic and Research 4	Sarah Sabour-Pickett	Prognostic indicators and outcome measures for patients with neovascular age-related macular degeneration undergoing treatment with intravitreal ranibizumab		Hogan Suite		
		Dr James Loughman	Macular pigment – focus on vision		Hogan Suite		
		Professor Roger Anderson	The perception of depth by simultaneous suppression and retinal dominance (SSSRD)		Hogan Suite		
	Members' Special Interest Group 4. Primary eye care	Sasha Macken	A review of Welsh Eye Care Initiative (WECI) registered optometrist referrals and GP notifications over a three week time period		Breakout Room 1		
		Neelam Patel	Enhanced optometric services in the UK: a review				
Case Study 4	John McGann	Heterophoric and accommodative anomalies – case studies		Breakout Room 2			
	Dr Joseph Pruitt	Successfully treated horizontal diplopia returns with subsequent traumatic brain injury					
	Pilar Cañadas-Suárez	Differential diagnosis of monocular diplopia					

Sunday 22 April				
Time	Session type	Presenter	Title	Room / Venue
11.30 – 12.30	Academic and Research 5 	Nilipa Shah	Effect of optical defocus on detection and recognition of vanishing optotype letters in the fovea and periphery	Hogan Suite
		Dr Sheila Rae	Accommodative accuracy with printed text vs. hand-held computer gaming	
		Pedro Serra	The effect of astigmatic blur orientation on different alphabets	
		Montserrat Tapias	Suitability of conventional typographies to measure visual acuity	
12.30 – 13.30	Case Study 5	Members' Special Interest Group 5		Breakout Room 1
		Kevin Gutsell	Why personalisation?	Breakout Room 2
		Sonali Patel	Contact lens fitting challenge	
12.30 – 13.30	Keynote Lecture 2 	Dr Kathryn Saunders		Hogan Suite
13.30 – 13.45	Closing address			
13.45 – 14.30	Lunch			

Programme correct at time of going to print.

The Academy has applied to the UK's General Optical Council (GOC) for continuing education points (CET) for some sessions. This colour coded key will help you identify which sessions have points applied for.

 Optometrists

 Dispensing Opticians

 Contact Lens

## Poster presentations

Research Education Clinical

Poster Presenter	Title
Dr Saud Alanazi	An investigation of the effect of head position when assessing dissociated and associated heterophoria
Abdulaziz Alkathiri	Central corneal thickness obtained by ultrasound and non-contact specular microscope with and without anaesthesia
Carolin Antonius	Diabetes, there is more to it than the eye
Dr Jan Bergmanson	Morning to afternoon osmolarity changes among silicone hydrogel contact lens and non-contact lens wearers
David Berkow	Fitting a hand-painted iris aphakic gas permeable contact lens
Dr Marie Bodack	Albinoidism: diagnosis and treatment
Dr Cristina Bonnin-Arias	Protein and lipid cleaning of blue light-filtering contact lens with cleaning and lubricant drops
Inmaculada Bueno-Gimeno	Distribution of macular parameters and their correlation with age in emmetropic Spanish children
Inmaculada Bueno-Gimeno	Relationship between corneal biomechanical parameters, retinal nerve fibre layer thickness and optic disc morphology in Spanish emmetropic children
Arnau Calatayud	Test bench for the assessment of the multifocal intraocular lenses
Eva Chamorro	Blue light-filtering contact lens parameter changes after multi-purpose solution cleaning
Agnieszka Charaziak-Kovács	The prevalence of visual impairment and blinches among the Roma population in Ukraine
Robert Conway	Variation in visual acuity measurement at different viewing distances: a comparison of results with two different chart designs
Dr Peter Davison	An evaluation of the City University Test (3rd Edition)
Hendrick Peter Derksen	Fitting telescopes for bioptic driving
Mahesh Kumar Dev	Impact of visual impairment on quality of life among older adults living in residential care
Phillip Fine	Slab-off versus prism-ballast back toric surface soft lenses: vision and comfort
Paul G.J. Gerringa	Visual acuity testing in a low vision practice using the PGRS chart with reversed sequence

<b>Poster presentations</b>		Research	Education	Clinical
<b>Poster Presenter</b>	<b>Title</b>			
<b>Trisevgeni Giannakopoulou</b>	Contrast sensitivity in one-eyed patients			
<b>Fabrice Gogniat</b>	Dynamic Contour Tonometry (DCT) over daily disposable hydrogel and silicone-hydrogel contact lenses with different dioptric powers and material characteristics			
<b>Cyril Guilloux</b>	The importance of the ophthalmic progressive lens shape on the space perception			
<b>Caroline Guy</b>	Baby vision			
<b>Eliška Hladikova</b>	Changing of intraocular pressure caused by a one-shot physical activity			
<b>Jeremiah Kelly</b>	Measuring the rate of dark adaptation; repeatability and an age effect			
<b>Professor Douk Hoon Kim</b>	Age and sex related changes of the corneal thickness and anterior corneal curvature in Korean young population with Orbscan II Topography			
<b>Sarah Lalor</b>	Where should the bars be to produce optimal crowding effects using children's acuity letters, pictures and symbols?			
<b>Roger Sin-fai Chiu</b>	Successful lid crutches fitting in patient with bilateral ptosis			
<b>Sasha Macken</b>	A review of Welsh Eyecare Initiative (WECI) registered optometrist referrals and GP notifications over a 3 week time period			
<b>Dr Ali Masmali</b>	Keratoconus in a Saudi population: associated clinical findings			
<b>Ann-Marie Masterson</b>	A comparative study of dry eye diagnosis testing systems using the TearLab Osmolarity system and Schirmer's tear test			
<b>Sara McCullough</b>	The relation between higher order ocular aberrations and visual function in children with and without Down syndrome			
<b>Rebecca McQuaid</b>	Corneal cross-linking (CXL) with second harmonic (SH) optical microscopy imaging and accelerated corneal cross-linking preliminary clinical results			
<b>Dr Langis Michaud</b>	Fabry's disease and other lysosomal storage disorders: the unique role of optometrists			
<b>Dr Langis Michaud</b>	Clinical comparison of hydrogen peroxide to cold chemical PHMB solutions for the care of gas permeable contact lenses			
<b>Dr Langis Michaud</b>	Evaluation of sodium hyaluronate lubricating drops used before insertion of contact lenses on symptomatology, severity and intensity of ocular dryness			
<b>Matjaž Miheličič</b>	Influence of induced astigmatism on reading performance			

Poster presentations		Research			Education		Clinical
		Poster Presenter	Title				
Professor Giancarlo Montani	Modification of the osmolarity with the use of contact lenses in omealficon a and methafilcon a materials						
Dr Paul Murphy	Why study optometry? What motivates student choice of optometry as a career?						
Dr Shehzad Naroo	Decreasing the load on the hospital eye service by using local optometric services						
Dr Shehzad Naroo	Ocular dominance in golf						
Pawel Nawrot	Body balance in adults with binocular vision disorders						
Professor Mireia Pacheco-Cutillas	Effect of form defocus and stimulus contrast reduction on the dynamic accommodative response						
Dinah Paritzky	"A little learning is a dangerous thing" (Alexander Pope 1709): educating towards standardization in optometry						
Dr Hetal Patel	In vivo measurement of scleral thickness in humans using anterior segment optical coherent tomography (AS-OCT)						
Neelam Patel	Enhanced optometric services in the UK: a review						
Mar Argudo Iturriaga	Biomechanical changes in corneas with keratoconus after implantation of two types of intracorneal rings						
Aoife Phelan	The Mozambique Eyecare Project – addressing uncorrected refractive error in Lusophone Africa through optometric education						
Aoife Phelan	Primary school vision screening involving teachers in Nampula, Mozambique						
Dr Sotiris Plainis	Effect of blur on reading performance: monocular vs. binocular vision						
Dr František Pluhaček	Influence of material and frequency of replacement of selected contact lenses on the tear film stability						
Esteban Porcar	Binocular dysfunctions in a population with low near vision						
Eleni Poulere	Clinical evaluation of the HRK-7000 autorefractometer based on the Shack-Hartmann principle						
Dr Joseph Pruitt	The curious case of the functionally legally blind patient with 20/25 (6/7.5) visual acuity						
Nancy Prussing	Simple device for improved visual functioning for client with right hemianopic defect						

Poster presentations		Research			Education		Clinical	
		Title						
Poster Presenter	Dr Sheila Rae	Assessing visual acuities at near with letter and symbol charts: effect of chart type and defocus						
	Dr Supaluk Raiyawa	Community screening for eye health problems, a horizontal integrated programme for eye health and eye care of better vision						
	Laura Remón	Reliability and repeatability on intraocular lenses optical characterization by Kaleo System						
	Nicholas Rumney	Achieving independent prescribing status as an optometrist; steps, costs, processes and outcomes						
	Professor Celia Sanchez-Ramos	Biosafety of hydrogen peroxide solution to disinfect blue light-filtering contact lens						
	Pedro Serra	The development of a reading speed chart in English and Portuguese						
	Kajal Shah	Evaluation of ophthalmic technicians, refraction service providers in Mozambique						
	Kajal Shah	Evaluation of student optometrists in Mozambique						
	Matthew Sheehan	Power calculation and customized designs for intraocular lenses using personalized eye models						
	Karen Sparrow	Creation of a pilot scheme to raise awareness of optometry & optics as career options for 14-16 year olds						
	Karen Sparrow	Evaluation of a pilot scheme in Uganda to support the national primary school vision screening programme with additional refraction services						
	Robert Szuba	Does an optometric investigation help to diagnose neuropathy?						
	Baskar Theagarayan	Binocular accommodative facility in pre-presbyopic Swedish adults						
	Stephen Thompson	A cost benefit analysis of an optometric higher education programme in Mozambique						
	Dr César Urtubia	Molecular genetics of retinitis pigmentosa: understanding the foundations of some retinal degenerative diseases						
	Diane Wallace	Faculty recruitment for a Portuguese-language optometry program: experiences and challenges of the Mozambique eye care project						
	Professor Abbas Yekta	Epidemiology of refractive errors among the elderly in Sari, Iran						

## Adaptive optics with a focus on new research

**Professor Pablo Artal,**  
University of Murcia, Spain

The use of adaptive optics allows the simultaneous measurement and manipulation of ocular aberrations in the eye of a subject while he or she is performing any type of specific visual task. This concept was first called adaptive optics visual stimulation and has been used in different experiments in visual science, optometry and ophthalmology in recent years.

This lecture will revise the basic concepts of this type of system, including several of the used corrector devices, and some of the vision science results obtained. As an example, the neural adaptation to aberrations was first suggested using an adaptive optics visual simulator. Another practical application is the search and evaluation of phase profiles to extend depth of focus to correct presbyopia.

The lecture will also review the current status of binocular adaptive optics visual simulators that extend the range of studies to the conditions of natural binocular vision. The future use of this technology as a tool for refraction analysis will also be covered. Some of the recent history, together with Professor Artal's personal views of the future developments of the field will also be presented.

### **Learning objectives:**

- The basis of adaptive optics technology and its applications in vision and optometry
- A summary of recent experiments and what they can tell us
- A overview of the future of adaptive optics technology in clinical optometry, including improvements to refraction and the fitting of contact lenses

### **Biography**

Pablo Artal is a professor of Optics at the University of Murcia, Spain, as well as the founder and director of the university's Laboratorio de Optica. An optical and vision scientist with interests in visual optics, optical instrumentation, adaptive optics, biomedical optics and photonics, Professor Artal has pioneered different advances in visual optics and optical instrumentation.

He has published more than 140 reviewed papers and presented more than 150 invited talks in international meetings around the world. He is currently editor of the Journal of the Optical Society of America and the Journal of Vision. He was elected fellow member of the Optical Society of America (OSA) in 1999 and a fellow member (inaugural) of ARVO in 2009.



# Clinical practice in relation to paediatric care

**Dr Kathryn Saunders,**  
University of Ulster, Coleraine, UK

This lecture will take an evidence-based approach to the assessment and management of young children in optometric practice, with particular regard to refractive error and its management.

The evidence surrounding risk factors for poor visual outcomes, particularly related to refractive error, amblyopia and strabismus, will be presented. Guidance will also be given on how research evidence helps in identifying where development is atypical and risks are heightened. The importance of robust and appropriate assessment techniques will be discussed and optometric management of children at risk for poor visual outcomes explored, using research evidence and case studies.

## **Learning objectives:**

- Appreciate the normal process of visual development in infancy and early childhood and what constitutes deviation from typical
- Understand how atypical development links to poor visual outcomes such as amblyopia and strabismus
- Appreciate the optometrist's role in management of paediatric vision for best visual outcomes
- Be able to identify which techniques can aid assessment of young children, particularly with regard to the need (or otherwise) for a refractive correction

## **Biography**

Kathryn Saunders is a Reader in Optometry and Vision Science at the University of Ulster, Northern Ireland, UK. In addition to undergraduate and postgraduate teaching and clinical work with young children, she is involved in research relating to visual development in infancy and early childhood; in particular the impact of neurological impairment on vision and the epidemiology and development of childhood refractive error. This work aims to better understand both the normal and atypical visual system and to improve the visual assessment, treatment and care offered to children.

Kathryn is an elected Council member for Northern Ireland of the College of Optometrists in the UK and also sits on the Research Committee of the College.

## Education Presentation

### An Accreditation Scheme for European Optometry

**Lead Author:** Robert Chappell

**Co-Author:** Adrian Jennings

European Council of Optometry and Optics

The standard of optometry education and practice is very variable throughout Europe. Given the European Union concept of the free movement of professionals there is a need for the harmonisation of optometric educational programmes and legislation to achieve a common standard for optometry. The European Diploma in Optometry (ED) was designed by the European Council of Optometry and Optics (ECOO) to encourage optometry schools to use it to design their syllabus and as an advocacy tool to increase the legal scope of practice.

But the ED is a 'big bang' examination out of the reach of many countries. However, all countries would meet at least some of the competencies of the Diploma. To encourage greater take up of the Diploma and its standard, and also to enable schools to benchmark their courses against the Diploma, ECOO has established a pilot accreditation scheme.

Accreditation will provide a benchmark for national qualifications against the ED and allow exemption for students from all or part of the examination. It will assist in the design of programmes and act as a stimulus for course development and eventual harmonisation. Additionally it will provide a tool to be used in advocacy to national governments to increase the scope of practice.

ECOO has designed an accreditation pilot scheme which is due for completion in Spring 2012. If this is successful and approved by ECOO then a permanent accreditation scheme will be established. Three schools which reflect different national standards have been piloted. One further school has developed a new programme and will complete the accreditation process when the first cohort has graduated.

Other countries have asked for new programmes to be evaluated and this could be a service to be offered as part of a permanent accreditation scheme.

We describe the process of accreditation and comment on the experiences thus far from the point of view of the accreditors and the institutions visited.

## Case Study Sessions

### Parental and professional views regarding eyecare services for children with Autistic Spectrum Disorder

**Lead Author:** P. M. Anketell<sup>1</sup>

**Co-Authors:** K. J. Saunders<sup>1</sup>, S. M. Gallagher<sup>2</sup>, J. A. Little<sup>1</sup>

<sup>1</sup> Vision Science Research Group, School of Biomedical Science, University of Ulster, Cromore Road, Coleraine, Northern Ireland, UK

<sup>2</sup> School of Psychology, School of Biomedical Science, University of Ulster, Cromore Road Coleraine, Northern Ireland, UK

#### **Purpose:**

The aim of this study was to explore experiences and attitudes around eyecare services for children with autistic spectrum disorder (ASD) in Northern Ireland. Parents and professionals in secondary eyecare settings were surveyed.

#### **Methods:**

A qualitative cross-sectional questionnaire based study was undertaken. Two questionnaires for professionals and parents were developed. The questionnaires were structured to elicit information regarding the services provided to children with ASD and the perceptions of the assessment undertaken. The location and appropriateness of eye clinic facilities and parental opinions regarding eyecare provision were investigated.

The questionnaire was distributed to all by hospital-based orthoptists (n=30), optometrists (n=29) and community ophthalmologists (n=5) in Northern Ireland. The parental questionnaire was distributed to 1,307 parents/ guardians via three local autism charities.

#### **Results:**

Thirty four (53%) professional questionnaires were returned. This represented 20 orthoptists, 12 optometrists and two community ophthalmologists. Orthoptists and community ophthalmologists report paediatric clinics represent, on average, 40% of their working week; whilst for optometry this was 28%. Fifty three percent reported assessing a child with ASD 'once a week'.

220 (17%) parental questionnaires were returned. The majority (84%, n=185) reported that their child had previously had an eye test at the local hospital eye clinic, their local primary care optometrist, at their school or at a child development multidisciplinary clinic. 32% of children had a history of spectacle wear.

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### **Parental and professional views regarding eyecare services for children with Autistic Spectrum Disorder**

Six professionals (17%) report providing visual assessment for children with ASD in paediatric-led child development clinics. Twelve (35%) regularly assessed children within special-needs schools; the majority of these report improved cooperation in this location compared to hospital clinical locations. Parents generally do not attend in-school vision testing, but where data is available the majority report that their child was more responsive in this setting. Overall, parents reported their child's visual assessment to be a positive experience (61%; n=94) with satisfaction increasing to 74% (n=54) when children are assessed by primary care optometrists.

**Conclusions:** As the numbers of children diagnosed with ASD is reported to be increasing there is potential for more children with ASD to present to eyecare services. Eyecare professionals will therefore increasingly be involved in the clinical management of this population.

Eyecare professionals complete vision assessments for this population in various locations. However, the current data supports the notion that assessment within special-needs schools may be most beneficial. Over half of parents sampled reported that eye tests were generally a positive experience for their child.

# Clinical characteristics of paediatric patients with exotropia

**Lead Author:** Marie I. Bodack

Cincinnati Children's Hospital, Cincinnati, USA

## **Purpose:**

To determine the clinical characteristics of paediatric (<13 years) patients with exotropia including patient symptoms, the frequency, laterality and magnitude of the deviation, classification of exotropia, presence of amblyopia, associated ocular and systemic conditions and treatments.

## **Methods:**

A retrospective chart review of patients under the age of 13, seen over a one year period at a children's hospital by either paediatric ophthalmologists or paediatric optometrists was conducted. All patients had a diagnosis of exotropia.

## **Results:**

A total of 668 charts were available for review. The average patient age was five. There was no gender predilection (332 male, 336 females). An eye turn was noted by 68% of patients as the reason for the exam. Twenty seven percent (27%) of patients were seen for a "routine" exam where an eye turn was not noted by the parent or patient.

Patient symptoms were not commonly asked. The most common symptom was diplopia (N=22, 2.1%) followed by headaches and head turn/tilt (both 13 patients, 1.8%). The most common systemic conditions were premature birth (N=40, 6%), brain injury (N=35, 5%), and seizures (N=30, 4%). The most common ocular conditions were nystagmus (N=26, 4%), optic atrophy (N=20, 3%), and history of cataracts (N=16, 2%). Decreased vision due to refractive or strabismic amblyopia was present in 105 patients (16%), bilateral refractive amblyopia in 11 (2%) and organic amblyopia in 59 (8%). The average deviation at distance was 19 prism dioptres (range 0 to 53), and at near was 16 prism dioptres (range 0 to 80). The magnitude of the deviation was the largest in patients in the first year of life (See Chart). The majority of cases were classified as basic exotropia (N=249) followed by divergence excess (N=182), and convergence insufficiency (N=101). The deviation was intermittent at distance and/or near in 438 patients and constant in 150. The majority of patients were emmetropic. 114 patients had a total of 167 prior surgeries, or an average of 1.5 per patient (range 1-6). Observation was the most common treatment (N=373). Alternate patching was prescribed for 138 patients, atropine for 26, vision therapy for 24, and overminus lenses for 21. During the study period, 87 patients had surgery, with another 38 scheduled. Results were available for 73/87 surgical cases. Ophthalmologically 57% were "successful" (deviation less than 10 prism dioptres) and 28% were not "successful." Seven patients (10%) developed hyper deviations. Three patients (4%) had additional surgeries planned, two noted diplopia and one developed a head turn.

## **Conclusions:**

Exotropia is a common optometric condition. Studies have found that most forms of childhood exotropia are intermittent and that intermittent exotropia improves over time for many patients. This study seems to support those findings. Systemic and or ocular conditions can be present in these patients. Further studies regarding treatment options and success rates are needed to determine the most appropriate clinical management.

## Contact lens options for patients with atopic kerato-conjunctivitis

**Lead Author:** Langis Michaud

Clinique Universitaire de la Vision (É.O.U.M.), Montreal, Canada

**Purpose:**

This case report aims to determine the optimal contact lens options to safely fit patients with atopic kerato-conjunctivitis.

**Methods:**

Atopic kerato-conjunctivitis is described in terms of incidence, risk factors and populations affected. Clinical features and effects on visual acuity are explored. Optical and pharmacological treatment options are presented.

**Results:**

S.S. is a Caucasian male of 52 years-old, referred by his ophthalmologist for contact lens fitting. Patient entering visual acuity was < 6/120 uncorrected and < 6/60 corrected with glasses. Reduced visual acuity was linked to abnormal ocular surface (irregular cornea and unstable tear film). Considering that atopic patients are very sensitive, a piggy-back system involving the use of a silicone hydrogel daily disposable lens, to protect the cornea, and of a rigid gas permeable lens to restore the visual function, was proposed and accepted. Daily disposable are also compatible with the use of multiple topical medications applied every day. A hydrogen peroxide system was recommended as a care regimen for the gas permeable lens. At the delivery, visual acuity reached 6/7,5 monocularly and 6/6 binocularly. Follow-up visits confirmed that this modality was well accepted without any increase in the atopic response of the immune system. Improved visual acuity helped to increase the quality of life of this patient.

**Conclusion:**

Atopic kerato-conjunctivitis is a chronic perennial sight-threatening disease that can alter the ocular surface and consequently reduce the visual function of the affected patients. A piggy-back system was used to minimise the potential impact on the ocular health. Visual restoration was possible and the outcome proved that contact lenses can impact positively on the quality of life.

## 3-D optic nerve head interpretations

**Lead Author:** Greg Black

**Co-Author:** Julie Tyler

Nova Southeastern University College of Optometry Fort Lauderdale, Florida, USA

### **Purpose:**

The purpose of this workshop is to give participants experience interpreting normal and abnormal optic nerve heads (ONH) utilizing slides of actual patients with a delivery method that allows the participant to view the optic nerve three-dimensionally.

### **Methods:**

Optic nerve head slides were obtained from a camera that produces a stereo-paired image in a single slide that are observed through a special viewer (below are examples of the slides used). The optic nerve images include optic nerves with cup-to-disc (C/D) sized varying from small C/D ratios to optic nerves completely cupped out from glaucoma. Additional slides include variants such as oblique insertion, tilted disks, congenital gliosis, myelinated nerve fibres, disk drusen, staphyloma, optic pit, pseudotumor cerebri, persistent hyperplastic primary vitreous, vascular occlusions glaucomatous findings, and others. The workshop entails viewing images first of projected slides on the computer screen, with the presenters describing the slides, then the participants viewing the individual slides with the viewer.

### **Results:**

The presenters both work in clinical settings where glaucoma patients are a large part of their practices. ONH evaluation is still the most important component of a glaucoma evaluation. The NICE guideline on the diagnosis and management of chronic open angle glaucoma and ocular hypertension lists ONH evaluation as a required competency. The learning objectives of this workshop are to familiarize the participants with a normal ONH with varying cup-to-disk ratios, allow them to identify variants of the ONH and to recognise pathological findings.

### **Conclusions:**

Optic nerve head evaluation is a necessary skill for optometrists to utilise to diagnose ocular pathologies including glaucoma. This workshop allows the participants three-dimensional views of common and uncommon ocular conditions with a focus on ONH findings in glaucoma.

## Heterophoric and accommodative anomalies

**Lead Author:** John McGann

Department of Optometry, School of Physics, Dublin Institute of Technology,  
Dublin, Ireland

**Purpose:**

Vergence and pre-presbyopic accommodative anomalies are commonly encountered by optometrists in practice. It is important firstly to correctly diagnose the condition and rule out possible pathology and then to decide on a management plan for the patient. These case studies will cover commonly encountered vergence and accommodative anomalies and detail the presenting symptoms, investigation and management decisions in each case.

**Case Studies:**

The case studies presented will include examples of convergence insufficiency, pseudo-convergence insufficiency and esophoria. They will demonstrate that while some cases may present with very similar signs and symptoms, they may require very different management. By detailing each case from first presentation through clinical investigation, sequential management during follow-up visits until discharge of the patient a clear management path will be mapped out for the various anomalies.

The case studies will show how investigative techniques such as accommodative and vergence facility testing and measurement of positive and negative relative accommodation can be incorporated into the eye examination routine to support correct diagnosis and management of these anomalies.



# Successfully treated horizontal diplopia returns with subsequent traumatic brain injury

**Lead Author:** Joseph A. Pruitt

**Co-Author:** Nancy Prussing

Minneapolis Veteran Affairs Medical Centre, MN, USA

## **Background:**

As presented during last year's EAOO meeting, a 47-year old white female presented to Traumatic Brain Injury (TBI) Eye Clinic complaining of horizontal diplopia for the last five years after having hit her head during a motor vehicle accident. Her diplopia was successfully treated with 12 weeks of vision therapy. However, patient returned to clinic approximately one year later complaining of diplopia once again, ever since falling and hitting her head on a step of a flight of stairs.

## **Case Report:**

Examination was unremarkable except for the following:

- cover test yielded eight prism dioptres intermittent alternating exotropia at distance and 18 prism dioptre constant alternating exotropia at near
- Maddox rod at near yield 18 prism dioptres exophoria without the presence of a vertical phoria
- prism bar fusional vergences and Near Point Convergence (NPC) were attempted, but immediate diplopia was noted with each test

Subjective refraction revealed compound hyperopic astigmatism refractive error and presbyopia of each eye.

The patient was once again diagnosed with convergence insufficiency and was prescribed vision therapy. Similar to the treatment regimen implemented one year prior, vision therapy was started. The patient's convergence insufficiency was once again successfully resolved, but this time with only six weeks of vision therapy.

## **Conclusion:**

Achieving success with a vision therapy treatment plan does not absolve the patient from potentially suffering from future binocularity issues. As seen with this patient, a subsequent head injury led to the reoccurrence of convergence insufficiency; thus double vision. However, resolution only took half of the amount of vision therapy and/or time as it did one year prior. This suggests that a recovery can be made when post-vision therapy events result in the re-emergence of binocular vision issues. The most important thing is to approach the treatment in the same manner as if it is the first time treating the condition.

## Differential diagnosis of monocular diplopia

**Lead Author:** Pilar Cañadas-Suárez

Universidad Complutense de Madrid, Madrid, Spain

**Purpose:**

This case study presents a monocular diplopia clinical case because of a macular hole and the clinical tests needed for differential diagnosis.

**Case Study:**

A 40 year-old woman presented with the following:

- UCVA 20/ 200 OD non improve with pin hole; and 20/20 OS
- Subjective refraction +0, 50 OD and plane with OS
- BCVA: 20/200 OD; 2020/20 OS
- Amsler grid: micropsia OD, an afferent pupillary defect in OD was observed
- No pathological findings were found with biomicroscopy
- No keratoconus suspect with topography
- +90 lens: macular alteration consistent with macular hole
- Optical coherence tomography confirmed the diagnosis of macular hole

**Conclusion:**

Monocular diplopia caused by a macular hole is a condition that is three times more common in women between 60 and 80 years old. It sometimes occurs in young adults. 10% are bilateral and cause decreased vision, about 20/200, and central scotoma.

# Why personalisation

**Lead Author:** Kevin Gutsell

Professional Services Director, Nikon Optical UK Ltd

## **Purpose:**

The purpose of the presentation is to clearly identify the features and benefits of personalising lens design according to specific parameters. The aim is to clearly show how and why lens personalisation provides improved vision performance for wearers of both single vision and progressive power lenses.

## **Methods:**

The way in which lenses can be personalised as well as why powers are compensated is also covered. The effect of changing lens curvature, according to more curved frames, is examined along with an explanation as to how lens designers and manufacturers can control the resultant aberrations. Iso cylindrical plots, power diagrams and field diagrams will be used to show how the lens performance is improved by personalising lens designs. How lens power compensation is calculated will also be demonstrated, and how the near performance of progressive lenses is improved with the customisation of the near vision inset according to known formulae.

## **Conclusion:**

To conclude, the session will take the information provided and examine how this should be correctly used in the consulting room and in the dispensing arena. Communicating the message and explaining the wearer benefits will be covered.

## Contact lens fitting challenge

**Lead Author:** Sonali Patel

**Co-Author:** Sophie Harper

Optometry Department, Manchester Royal Eye Hospital, Oxford Road, Manchester

**Purpose:**

Case presentation of a 57 year-old keratoconic female (EH) seen in the emergency eye centre (EEC) four months after the insertion of stromal ring to her left eye. EH's management pathway and the subsequent contact lens and aftercare fitting challenges are discussed.

**Method:**

The patient presented complaining of reduced vision and a sore left eye. A diagnosis of microbial keratitis was made and the stromal ring was removed after two days. Subsequently EH was referred to the optometry department for contact lens management two months later. Slit-lamp examination revealed an imprint of the aforementioned stromal ring and corresponding stromal scarring, together with an irregular corneal profile and topography. The patient also presented with right eye (RE) rigid gas permeable (RGP) lens 0.04 LogMAR, left eye (LE) unaided vision 0.9 LogMAR, Refraction -2.50DS 0.2 LogMar. As an existing right rigid contact lens wearer, the following options were discussed:

1. Mono vision
2. Right contact lens/left spectacle Rx (with reading Rx incorporated)
3. Bilateral contact lenses/reading spectacle Rx over contact lenses

**Results:**

EH opted to have both eyes fitted with RGPs. She was able to wear her contact lenses for eight to 10 hours a day (seven days a week) with a good subjective level of comfort. Her visual acuity was 0.04 LogMAR each eye. She experienced no further eye infections or contact lens related problems.

**Conclusion:**

The patient was fitted with rigid contact lenses to both eyes and achieved a successful outcome both visually (achieving visual acuity of +0.04 LogMAR right and left), and with regard to contact lens tolerance and comfort.

## Clinical Workshops

### Detection and management of lid margin disease

**Lead Author:** Caroline Christie<sup>1</sup>

**Co-Authors:** Mirjam Van Tilborg<sup>2</sup>, Giancarlo Montani<sup>3</sup>

<sup>1</sup> City University, London

<sup>2</sup> Department of Optometry, Hogeschool Utrecht, University of Applied Science, Utrecht, The Netherlands

<sup>3</sup> Centre for Contact Lens Research, University of Salento, Italy

#### **Introduction:**

Common, problematic and often under-diagnosed, lid margin disease (LMD) is at the root of many cases of dry eye, complaints from patients about ocular discomfort and high contact lens dropout rates.

The diagnosis and treatment of LMD can be especially challenging, and diagnosis is difficult because LMD and ocular surface conditions often coexist, with overlapping signs and symptoms. Treatment is complicated because LMD typically is a chronic condition requiring long-term management. Furthermore, no comprehensive, universally accepted treatment approach exists. However, progress is being made.

Interest in the best ways to diagnose and manage LMD is increasing. New insights into the interactions of eyelid microflora, meibomian gland function, tear film function and the inflammatory mediators responsible for the clinical manifestations of LMD have resulted in new therapies improving our ability to manage LMD, and significant additional advances appear to be on the horizon.

#### **Workshop aims:**

This workshop aims to follow current thinking and take delegates on a journey to assist them in the steps required to improve the care of patients with LMD.

Delegates will rotate in small groups around a series of work stations where the facilitators will demonstrate how best to “look, feel and hear” their way through this notoriously under-recognised and subsequently under treated condition.

#### **Methods:**

The “look” station will involve delegates examining the anterior eye, lid margin and tear film of “real patients” using simple yet highly effective slit-lamp techniques to determine the type and extent of the condition presented. It will also allow delegates the opportunity to evaluate some of the latest clinical available instruments to further classify the condition.

The “feel” station will allow delegates to trial and appraise the latest European products for the cleansing of lid margins and include a live demonstration of warm compresses from wet flannels through microwaveable eye bags to the latest moist heat goggle systems.

The “hear” station will enable delegates the opportunity to assess the effectiveness of a range of clinically available dry eye questionnaires frequently cited in journals by listening and discussing the results from fellow delegates. This station will also stress the importance of patient education, since once a dry eye condition (in particular lid margin disease) has been diagnosed then many of the management strategies rely strongly on patient compliance. Delegates will be provided with samples of written material to improve patient understanding and compliance with lid margin management therapies.

## Introduction to slit lamp ophthalmoscopy

**Lead Author:** Holger Dietze

Beuth University of Applied Sciences, Berlin, Germany

This workshop will allow the participant to understand basic principles for assessing the back of the eye and to apply three-dimensional slit lamp ophthalmoscopy (90D ophthalmoscopy). The workshop is comprised of a short lecture and practical exercises on real eyes. The lecture compares signs and variants of the normal eye with common signs for pathological changes, such as cotton wool spots, exudates, retinal atrophy and haemorrhages. Emphasis will be put on the investigation of the optic nerve head, its neuro-retinal rim and the excavation. In the hands-on part of the workshop the participant will perform a supervised 90D-slitlamp-ophthalmocopy on a dilated/undilated eye with emphasis on the optic nerve head.

# Fitting rigid gas permeable scleral contact lenses on patients with distorted corneas

**Lead Author:** Philip Fine<sup>1</sup>

**Co-Author:** Liat Gantz<sup>1</sup>, Nogah Bromberger<sup>2</sup>

<sup>1</sup> Department of Optometry and Vision Science, Hadassah Academic College, Jerusalem, Israel

<sup>2</sup> Faculty of Optometry, Bar-Ilan University, Ramat Gan, Israel

Rigid gas permeable scleral contact lenses (RGPSCL) offer improved quality of life and excellent visual acuity in cases of severe corneal distortions, keratoconic patients on a waiting list for corneal transplant and patients with extreme dry-eye syndromes such as Steven-Johnsons syndrome. In this workshop participants will learn, in a hands-on approach, how to fit RGPSCL. The fitting procedure is independent of keratometry and refraction. The appropriate initial RGPSCL is chosen on the basis of corneal inspection and its fluorescein pattern and slit lamp examination will be used to assess the quality of fit. The parameters that need to be modified in order to improve the fit will be discussed and a more appropriate lens will be inserted and assessed until an acceptable fit is achieved.

Participants will have the opportunity to practise lens insertion and removal and to evaluate the contact lens fit throughout the fitting process.

## Checking and dispensing prisms

**Lead Author:** Patricia Mordaunt<sup>1</sup>

**Co-Author:** Claire McDonnell<sup>2</sup>

<sup>1</sup> National Optometry Centre, Dublin Institute of Technology, Dublin, Ireland

<sup>2</sup> Department of Optometry, Dublin Institute of Technology, Dublin, Ireland

This is a workshop suitable for both optometrists and dispensing opticians. Delegates will receive instruction in how to check for/measure the following: unwanted vertical and horizontal prism in single vision spectacles, geometric drop on bifocal spectacles and thinning prism in varifocal lenses. Delegates will also learn why it is necessary to make these checks in practice. With the help of the workshop presenters and the handouts provided, delegates will then have the opportunity to make the above measurements on pre-measured spectacles using either a manual or an automatic focimeter.

The workshop also covers Fresnel prisms, Peli prisms (for hemianopia), bicentric single vision, bifocal and varifocal lenses and delegates will have the opportunity to see samples of all of the above. The presenters will also go through alternative methods of dealing with anisometropic prescriptions (e.g. different segment sizes in bifocals) and delegates will be shown how to assess if an anisometrope would benefit from a bicentric lens.

### **Learning outcomes:**

At the end of this workshop delegates should be able to:

- check single vision spectacles for unwanted vertical and horizontal prism
- measure geometric drop on bifocal spectacles
- measure the thinning prism in a pair of varifocal lenses
- understand why inter-lens differences in geometric drop and thinning prism could cause problems for a patient
- decide when a Fresnel lens should be used but also know the disadvantages of Fresnel lenses
- test an anisometrope to see if they require bicentric lenses but also know the disadvantages of bicentric lenses
- understand the purpose of a Peli prism and understand how the Peli prism works

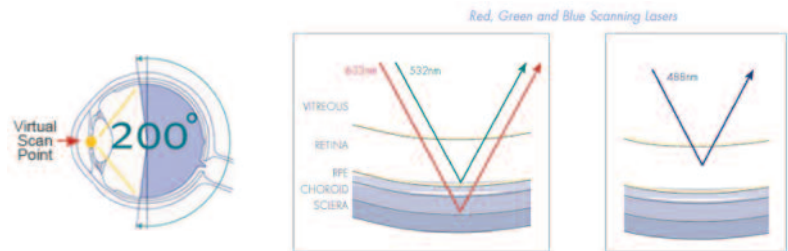


# Optomap workshop

**Lead Author:** Anne Salmon

Dublin Institute of Technology, Dublin, Ireland

Optomap is a non invasive, non mydriatic retinal imaging system which allows the practitioner to obtain a 200 internal degree retinal image at one time, simultaneously viewing central pole, mid peripheral and peripheral retina without the need for dilation. This is achieved by employing the optical properties of a large ellipsoidal mirror to create a 'virtual' focal point located posterior to the patient's iris plan.



Unlike full spectrum white light used in conventional devices, Optomap incorporates low-powered laser wavelengths that scan simultaneously. This allows review of the retinal substructures in their individual laser separations:

- Green laser (532nm) scans from the sensory retina to the pigment epithelial layers
- Red laser (633nm) scans from the RPE to the choroid

Once the optomap image is captured, practitioners use the proprietary review software for evaluating and manipulating the images. Adjustments to magnifications, contrast and brightness enable the clinician to enhance areas of interest and highlight fine details of the individual laser separations. In addition, measurements, annotations, clinical notes and diagnostic codes may be added and saved with the image. This workshop will teach delegates how to operate the optomap system, use the review technology and allow hands on experience with the optomap device.

The second part of the workshop will involve case discussion on retinal images from the optomap library of images. These case studies will include:

- disc oedema reveals frontal lobe tumour
- sickle cell retinopathy
- choroidal melanoma and non-rhegmatogenous retinal detachment
- malignant choroidal melanoma and retinal detachment
- chorioretinal atrophy
- diabetes mellitus
- glaucoma
- pigmentary retinopathy
- multifocal central serous retinopathy
- diabetic retinopathy.

## Discussion Forums

### Rigid gas permeable (RGP) lens teaching in educational institutes across the European community

**Presenter:** Judith Morris<sup>1</sup>

**Co-Author:** Caroline Christie<sup>2</sup>

<sup>1</sup> International Association of Contact Lens Educators

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A quote from "Obituary – Rigid Contact Lenses" by Nathon Efron (2010):  
"A combination of technological developments, market forces and the natural evolution of modern optometric practice have lead to the demise of rigid lenses."

The authors have noted that under-graduate education in the field of contact lenses, but especially RGP lens fitting, in recent years is under pressure of the ever evolving scope of the professions into respective directions of refraction and ocular disease with an increasing number of countries involved in diagnostic and even therapeutic management. Whilst a logical and welcome development more time in schools is devoted to these new areas of interest, while RGP contact lens fitting may no longer be receiving the attention it deserves.

Observing these trends the authors find themselves asking the following questions: What if the Educational Institutes chose only to educate students to a certain level / degree based on the wider marketplace and current trends. Is this a real threat to RGPs or just a hypothetical situation?

"Do recently qualified contact lens practitioners have the skills to examine and refit existing RGP wearers?" and perhaps more importantly "Will future newly qualified contact lens practitioners have the skill set to deal with long term RGP wearers?"

The authors will present data collected during the current academic year 2011/12 from Educational Institutes across the European Community. This data will be presented by region, Northern, Central and Southern Europe. However where there are any significant intra regional variances in data, individual country data will be used to further the understanding of why these differences have arisen.

Key discussion areas arising from the collated questionnaires will include; hours of didactic contact lens teaching versus percentage of this time dedicated solely to RGPs; hours spent fitting contact lenses to fellow students and percentage of this dedicated to RGP lenses; hours spent fitting "real patients" with contact lenses and estimated percentage of this related to RGP lenses whether fitting or aftercare. Further information gleaned will include involvement by the RGP industry in didactic lecture presentations and "hands-on" workshops, time spent in observation and practical sessions in specialist practice environments and availability of a higher qualification course in contact lenses.

The authors would like to thank the assistance of IACLE colleagues in translation and collection of data and would welcome their contribution to the discussion session.

# Can questionnaires predict the clinical practice of optometrists in glaucoma detection?

**Lead Author:** JG Lawrenson<sup>1</sup>

**Co-Authors:** J Theodossiades<sup>2</sup>, J Myint<sup>1</sup>, IE Murdoch<sup>2</sup>, DF Edgar<sup>1</sup>

<sup>1</sup> Department of Optometry and Visual Science, City University, London, UK

<sup>2</sup> Glaucoma Unit, Moorfields Eye Hospital, London, UK

## **Purpose:**

Questionnaires are commonly used as a proxy measure of clinical practice; however their application in a variety of healthcare settings has found significant self-reporting bias. The aim of this study is to estimate the validity of questionnaires as a measure of optometrist case-finding practice for glaucoma and the appropriate referral of suspects.

## **Methods:**

Two complementary approaches were used:

1. A sample of optometrists (N=34) on an ophthalmic list in West London were visited incognito by Standardised Patient (SP) volunteers aged over 54 who were trained to identify the components of a standard sight test. Optometrists from the same list were then invited to participate in a structured face-to-face interview regarding their case finding practice for glaucoma.
2. As part of a national glaucoma survey of optometrists, respondents (N=1264) were asked in a free text question for the information that they would include in a referral letter for suspect glaucoma. The responses were compared to the content of a sample of glaucoma referral letters (N=571) obtained from consultant ophthalmologists across the UK.

## **Results:**

For the SP study there was complete correspondence between the questionnaire and volunteer reports for the routine assessment of ocular health and refraction. No correspondence was found for questions relating to a complete history and symptoms, measurement of intra-ocular pressure or visual fields. For the referral study, correspondence between survey findings and referral letters was obtained for IOP only. No correspondence was found for disc assessment, visual fields or family history of glaucoma.

## **Conclusions:**

The overall findings from both studies indicate that clinical practice questionnaires overestimate routine tests undertaken by optometrists in practice. Although there was a good correspondence for mandatory tests, correspondence was poor for discretionary tests. These findings should be borne in mind in all questionnaire studies that report current practice in glaucoma case-finding.

## **Acknowledgements:**

Joy Myint is funded by an unrestricted grant from Pfizer Ophthalmology.

## Communication – a necessity and a success factor in the optometric practice

**Presenter:** Helmer Schweizer

President, EUROMCONTACT

Effective communication is essential for success in all aspects of life, not only in business. Eye care professionals are usually great experts on the technical side of the profession, yet have not had formal training in communication.

Basic knowledge about communication theory is the basis and the foundation for a more conscious approach to and handling of communication. Awareness and ability to realise why things may not work as normal and the ability to react appropriately can be learnt.

Understanding communication principles enables the eye care practitioner to better deal with different situations in the optometry practice and to be more effective. It is important to learn to observe and listen more and with attention.

Good communication is not a secret, everybody can do it. It requires some self discipline and self awareness, and the ability and willingness to listen.

**Learning objectives:**

- understand communication principles
- be able to use communication to handle different situations in the optometry practice better
- communicate more effectively
- learn the importance of observing and listening

# The effect of legislation on optometric practice: an illustration from the Netherlands

**Lead Author:** Annemieke Coops

Dutch Optometric Association (ONV), the Netherlands

## **Purpose:**

To assess the workplace practice of Dutch optometrists.

## **Methods:**

All members of the Dutch Optometric Association (Optometristen Vereniging Nederland, ONV) (n=954, approximately 80% of all practising optometrists) were invited to participate in a questionnaire. The respondents (n=405) described their workplace practice relating to mode of practice, clinical procedures, and use of diagnostic drugs. Data collection took part between April and May 2010.

## **Results:**

Optometrists work in a variety of practice settings: 56.7% work in general optometric practice, 4.2% in specialized referral based optometric practice, 25.8% in hospitals, and 5.3% in refractive surgery clinics. 8% of respondents were not working in clinical practice at time of survey, therefore were not included in the data collection addressing clinical practice.

90.9% of optometrists take case history on all or almost all of their patients, 98.1% measure visual acuity, 90.6% perform refraction, 23.7% assess pupils, 7.1% perform confrontation fields, and 38.4% perform applanation tonometry. Anterior segment evaluation is conducted by 88% of optometrists on all or almost all of their patients, however, posterior segment evaluation using slit lamp ophthalmoscopy is done by 49.7, and peripheral retinal evaluation using binocular indirect ophthalmoscopy is done by 16.1%, with 81.2% reporting that they never or seldom perform this procedure. One third (33.6%) state that they are using diagnostic drugs on a frequent basis.

## **Conclusion:**

For the last 10 years in the Netherlands, legislation defining optometry was expanded to include the use of diagnostic drugs and allow for an expanded scope of practice. Most Dutch optometrists take patient history, measure visual acuity, and conduct refractions. However, fewer Dutch optometrists are practicing full scope optometry as permitted by the law, especially in the area of retinal evaluation.

Barriers limiting the practice of full scope optometry need to be further evaluated and addressed if the majority of Dutch optometrists are to practice at the level allowed by legislation.

## Integrating optometry into primary healthcare

**Presenter:** Catriona Barrett

**Co-Author:** James Loughman

Dublin Institute of Technology, Dublin, Ireland

**Purpose:**

Shared eye care between medical professionals and optometrists has become common in the United Kingdom. Protocol is now in place for optometric provision of care in progressive eye diseases, such as glaucoma and age related macular degeneration. A referral refinement service for glaucoma suspects is now being launched in Dublin at the National Optometry Centre. It is anticipated that this scheme will be the first step towards expanding the role of Irish optometrists in the care of glaucoma patients.

**Method:**

The proposal is for a discussion forum to facilitate engagement on the issue of shared care. The Dublin referral refinement scheme is an example of a working model of shared care. We believe that utilising the skills of community optometrists will enable the overburdened Irish health service to deal with the projected rise in demand for eyecare services. As part of the discussion delegates are invited to consider this model of shared care and other schemes or planned schemes they are involved in. In the interest of stimulating debate questions would be raised on the potential benefits and pitfalls of shared care systems, the possibilities and rationale for development of enhanced scope optometry throughout Europe.

**Results:**

This conference provides the opportunity for eye care professionals to debate the slowly evolving clinical role of optometrists. The key goal is to allow for intelligent discussion between experts. By sharing information and voicing opinion we can help guide future change in the profession.

**Conclusions:**

Enhanced responsibilities for optometrists cannot be achieved without the support and commitment of the profession. It is important we make informed choices about our future role as clinicians. Through this discussion forum delegates are given the chance to show their support or voice their concerns about the further integration of optometry into primary healthcare.

# Creating uniformity and high level scope of optometric practice in the United States: the importance of standardization of optometric education

**Lead Author:** Roger D. Kamen

Michigan College of Optometry, Ferris State University, Big Rapids, MI, USA

Over the last four decades optometry in the United States has achieved a surprising level of uniformity and massive scope expansion given the different regulations in over 50 separate jurisdictions. There is no national licensure; optometrists are licensed by each jurisdiction under regulations of that jurisdiction. For example, in each of the 50 states, the scope of practice is delineated by state law and requires passage of optometric practice acts in each state. Any change in scope of practice requires the passage of additional legislation to modify the optometric practice act.

Optometry has achieved a high level of scope of practice across the states but not without struggles, similar to the ones currently underway in Europe. The standardisation or uniformity of optometric education in the United States has been a major component of this success.

A triad of organisations were major players in the achieving this uniformity. The first organisation is the Association of Schools and Colleges of Optometry (ASCO). ASCO provides leadership in optometric education to the 20 optometric programmes and has delineated attributes needed by graduates of schools and colleges of optometry, i.e., entry level competencies. First published in 2000, the attributes consist of three major categories: knowledge, skills, and professionalism. While each school develops its own curriculum, the attributes serve as a common template. Michigan College of Optometry, for example, has adopted the attributes as a basis for its curriculum.

To be licensed by a state the optometrist must be a graduate of an accredited optometric programme. The Accreditation Council on Optometric Education (ACOE) is responsible for accrediting each programme. Seven standards have been adopted by ACOE for accreditation. Each optometric programme must provide evidence (by way of a self study) of having met each of these standards. Standard II requires evidence that the curriculum adequately prepares the graduates for entry level practice as defined by the optometric programme. The ASCO attributes play a major role in this definition. After completing the self study, a site visit of three days in length is scheduled. Accreditation may be up to seven years.

Completing the triad of organisations is the National Board of Examiners in Optometry (NBEO). While each state grants licensure, nearly all states accept the passing of all three parts of the National Board Exam as evidence of entry level competency. This acceptance of the National Board Exam by the states' boards of optometry further facilitated the uniformity in optometric education at a high level.

These three organisations working in harmony with the optometric programmes have succeeded in creating an environment that is conducive for high level optometric practice.

## Oral Presentations

### Risk factors for childhood myopia: the NICER Study

**Presenter:** Karen Breslin

**Co-Authors:** Dr Lisa O'Donoghue, Dr Kathryn Saunders

Vision Science Research Group, University of Ulster, Coleraine

**Purpose:**

Outdoor activity has recently been reported to have a protective effect against the development of myopia in childhood. Other risk factors including family history and environment have also been proposed. The present study evaluates the risk factors for the development of myopia amongst a cohort of Northern Irish children.

**Methods:**

The Northern Ireland Childhood Errors of Refraction (NICER) study used stratified random sampling to identify a representative group of children in which to investigate prevalence of refractive error. Initially 399 6-7 year-old and 669 12-13-year-old children were examined. Parental questionnaires were administered; including questions on parental refractive error status. Assessment of economic deprivation and urban/rural classification were based on the participants' home address. After 36±3 months participants were invited for repeat examination (aged 9-10 years and 15-16 years) at school. Each participant completed a short questionnaire including questions relating to time spent on outdoor activity, visual activity and exercise. Participant refractive errors were determined by cycloplegic autorefraction (1 drop 1% cyclopentolate HCl). Axial length was measured using the Zeiss IOLMaster. As right and left eye data were correlated results are presented from the right eye only.

**Results/Data:**

Myopia was defined as at least -0.75 D in each meridian. Risk factors were explored separately for the development of myopia using univariate logistic regression adjusted for cluster design. A multiple logistic regression model was constructed for those factors showing significant associations under univariate analysis. Odds ratios (OR) with 95% confidence intervals were calculated for both analyses.

Of the original participants, 75.7% and 65.2% of the younger and older cohorts respectively were re-examined. Amongst the younger cohort, only lower SER (OR 0.02, CI 0.00 to 0.05) and longer AL (OR 10.88, CI 2.89 to 40.92) at baseline were identified as significant risk factors for the development of myopia. Amongst the older cohort, whilst lower SER at baseline (OR 0.02, CI 0.00 to 0.11) was a significant risk factor, having two myopic parents (OR 3.49, CI 1.01 to 12.92) was the strongest predictor for future myopia.

**Conclusions:**

Our data do not support the protective effect of outdoor activity on the development of myopia in children in Northern Ireland. Lower SER at baseline increased the risk of future myopia in the NICER cohort, and having two myopic parents was the most significant risk for developing myopia during teenage years.



# The relation between optical factors on accommodative responses in children with Down Syndrome

**Lead Author:** Julie-Anne Little

**Co-Authors:** Sara McCullough, Kathryn Saunders

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

## **Purpose:**

Individuals with Down syndrome commonly have deficits in accommodative function. Recent work from our laboratory has shown greater levels of higher order ocular aberrations (HOA) and reduced optical quality in children with DS compared with age-matched typically developing children. The present study investigates the relation between HOA and optical quality on accommodative responses in children with DS.

## **Methods:**

Participants were 30 children with DS (six to 16 years) and 201 age-matched controls. Accommodative responses were measured using modified Nott dynamic retinoscopy with fixation at 25cm. HOA aberrations were measured following cycloplegia for the dominant eye using Shack-Hartmann aberrometry (IRX3, Imagine Eyes). The Zernike coefficients trefoil of the sine  $Z(3,-3)$  and cosine phases  $Z(3,3)$ , vertical  $Z(3,-1)$  and horizontal coma  $Z(3,1)$  and spherical aberration  $Z(4,0)$  were used for analyses. Strehl ratios were also derived from HOA data to describe optical quality.

## **Results/Data:**

Pearson's correlations revealed a statistically significant relation between accommodative responses and spherical aberration  $Z(4,0)$  for both the DS and control groups ( $r = -0.46$ ,  $p < 0.05$  and  $r = -0.17$ ,  $p < 0.05$  respectively). Statistically significant relations were also found between accommodative response and trefoil of the sine phase  $Z(3,-1)$  ( $r = 0.20$ ,  $p < 0.001$ ) and vertical coma  $Z(3,-1)$  ( $r = -0.17$ ,  $p < 0.05$ ) for the control group. Chi-squared analysis revealed a statistically significant relation between a negative spherical aberration  $Z(4,0)$  value and a significant accommodative lag ( $\chi^2 = 4.89$ ,  $p < 0.05$ ) for the DS group, but not for the control group ( $\chi^2 = 1.10$ ,  $p = 0.29$ ); in which proportionally fewer participants demonstrated significant accommodative lags. Pearson's correlation also showed a weak but non-significant relation between Strehl ratio and accommodative response in the DS group ( $r = -0.20$ ,  $p = 0.29$ ).

## **Conclusions:**

Accommodative response was significantly correlated with spherical aberration in both groups, with increasing amount of negative spherical aberration associated with increasing amounts of accommodative lag for the DS group. Negative spherical aberration has previously been associated with flatter posterior crystalline lens surfaces and denser crystalline lenses suggesting a possible mechanical restriction to accommodation. Accommodative response also showed a weak negative correlation with Strehl ratio for the DS group. It has been reported that more aberrated eyes with poorer optical quality have a greater depth of focus. This may suggest children with DS have an increased tolerance to blur; implying sensory deficits may also provide an explanation to reduced accommodative function in DS.

## Myopia onset prediction in schoolchildren

**Presenter:** Karla Zadnik

**Co-Authors:** Loraine T. Sinnott, Donald O. Mutti

Ohio State University, Ohio, USA

**Purpose:**

To develop a model for the prediction of juvenile myopia onset.

**Method:**

A total of 4,512 children enrolled in the Collaborative Longitudinal Evaluation of Ethnicity and Refractive Error (CLEERE) Study were available for analysis, having excluded children who entered the study myopic. 414 children became myopic between ages eight and 14, with annual incidences ranging from 3.7 to 5.4%. Candidate predictors included: baseline refractive error (SPHEQ by cycloplegic autorefraction); parental history of refractive error (AnyMP); dioptric hours; hours spent per week outdoors; axial length (AL); lens thickness; corneal power (CP); Gullstrand lens power (GLP); AC/A ratio; relative peripheral refraction; accommodative lag, and astigmatism (J0, J45). Using discrete time survival analysis, models were created and areas under the curve (AUCs) computed.

**Results:**

This data-driven method generated candidate models for baseline ages six to 12 with a total of eight unique variables (SPHEQ, AnyMP, AL, AC/A, CP, GLP, J0, and J45), from which we created five models ranging from a model with all 8 variables to one with only SPHEQ. AUCs in this model ranged from 0.768 to 0.966; only the models trying to predict myopia at age 14 from age six data yielded unacceptably low AUCs. Because of the similarity of the AUCs, effort was concentrated on a model predicting myopia at ages eight through 14 from age seven SPHEQ data only. Separately, it was determined that non-cycloplegic SPHEQ data yielded unacceptably poor AUCs. The SPHEQ cutpoint that predicted myopia from age seven data across ages eight through 14 ranged from +0.41 to +0.58 D and yielded sensitivities ranging from 0.716 to 0.905 and specificities from 0.622 to 0.762.

**Conclusions:**

Data from eight-year-old children yielded a single best predictor of myopia onset: spherical equivalent refractive error as measured by cycloplegic autorefraction, and mild hyperopia at age eight was the optimum cutpoint for predicting myopia onset between ages nine and 14. The usefulness of this predictor depends on the safety and efficacy of any proposed preventive treatment for myopia.

## Astigmatism in childhood: the NICER Study

**Lead Author:** Lisa O'Donoghue

**Co-Authors:** Karen Breslin and Kathryn Saunders

Vision Science Research Group, University of Ulster, Coleraine, Northern Ireland, UK

### **Purpose:**

This study aims to address the paucity of data on how astigmatism changes with age throughout later childhood by presenting prospective data on refractive astigmatism and its association with refractive error in Northern Irish children with a high prevalence of astigmatism.

### **Methods:**

The Northern Ireland Childhood Errors of Refraction (NICER) study used stratified random sampling to identify a representative group of children in which to investigate prevalence of refractive error. Initially 399 six - seven year-old and 669 12-13 year-old children were examined (Phase 1). After  $36\pm 3$  months these children were invited for repeat examination (aged 9-10 years and 15-16 years, Phase 2). Refractive error was assessed by cycloplegic autorefractometry (1 drop 1% cyclopentolate HCl).

### **Results/Data:**

As right and left eye data were correlated results are presented from the right eye only. Astigmatism was defined as at least 1DC. Refractive error was classified as myopia if  $\leq -0.75D$  in each meridian, hyperopia if  $\geq +1.25D$  in each meridian, and emmetropia if between  $-0.25$  and  $+1.00$  in both meridians. Prevalence estimates with 95% confidence intervals were adjusted for the cluster design. The Chi-squared test was used to examine the difference in prevalence of astigmatism between the two age groups and the Kruskal-Wallis test was used to examine differences in incidence of astigmatism with refractive error classification.

Of the original participants, 75.7% and 65.2% of the younger and older cohorts respectively were re-examined. The prevalence of astigmatism had not changed significantly over the three year period and at Phase 2 there was no statistically significant difference in the prevalence of astigmatism between the two age groups (17.6% (CI 13.6-21.7) at age 9-10 years and 17.5 (CI 13.6-21.4) at age 15-16 years). There was also no statistically significant difference in the incidence of astigmatism (15.8% (CI 11.0-20.6) and 11.1% (CI 7.8-14.5) in the younger and older cohorts respectively). There was no statistically significant difference in the refractive error classification of either those who became astigmatic or those who were no longer astigmatic in both age groups.

### **Conclusions:**

This prospective study shows that whilst the prevalence of astigmatism remains constant throughout later childhood, some individuals develop astigmatism whilst some become non-astigmatic. However these changes do not appear to relate to refractive status.

## Does participation in postgraduate education change the way optometrists practise?

**Presenter:** Claire McDonnell

Department of Optometry, Dublin Institute of Technology, Dublin, Ireland

### **Purpose:**

Most qualified optometrists in the UK, Ireland and North America are required to partake in some form of continuing education (CE) or continuing professional development (CPD) to maintain professional registration. While much research has been done on the effectiveness of, for example, continuing medical education (CME) there appears to be a dearth of research relating to CE with respect to optometrists. This study looks at whether participation in two specific optometry workshops resulted in a change in practice for the participants, subsequent to the workshop. One of the workshops was defined as CPD as it involved teaching a new skill. The other was defined as CE as it involved refreshing existing skills.

### **Methods:**

Irish optometrists who had attended a CPD workshop on punctal plugs and lacrimal syringing were surveyed by email and telephone between four and 12 months post-workshop to ascertain if they had made a change to their practice since attending the workshop. A further group of Irish optometrists who had attended a CE workshop on binocular vision were surveyed by email, telephone and post between six and seven months post-workshop to ascertain if their practice had changed.

### **Results:**

A minority had changed the way in which they practised post-workshop regardless of the workshop attended. Those who attended the CPD workshop were asked to give a reason why they had not attempted one or both procedures and 39% cited the need for more practise as their main/sole reason.

### **Conclusions:**

These findings are different to those found in other systematic reviews which looked at changes in medical practice after doctors attended postgraduate workshops. The reviews found that "interactive educational workshops can result in moderately large changes in professional practice" (O'Brien and Freemantle, 2001). However it seems that a single CPD workshop in a completely new clinical skill is insufficient to effect a change in practice for the majority of optometric practitioners. Peer support and reinforcement of educational material appear to be important factors in influencing optometrists to instigate new practices or change existing practices. A CE workshop designed to refresh existing skills may have limited impact on the way in which optometrists practise because it does not challenge their existing beliefs.

# Optometry students' learning outcomes when e-learning a professional optometry course

**Lead Author:** Kaarina Pirilä

Metropolia University of Applied Sciences, Department of Optometry, Helsinki, Finland

## **Purpose:**

In the department of optometry in Metropolia the use of e-learning is quite a new paradigm. Strategic decisions were made on to adopt e-learning techniques to be used in the university. The social interaction among the e-learners is crucial for knowledge construction, mutual support, and for the reduction of isolation and anxiety during the independent learning process. This study investigates how the level of interaction impacts upon the quality of optometry students' learning and knowledge, the attitudes towards e-learning and students' opinions of the advantages and disadvantages of this kind of learning.

## **Methods:**

The data was collected when the first year students of optometry (N=79) in Metropolia participated in a professional optometry course called "Basics of Lens Technology". The students were assigned into two different learning conditions: asynchronous (A) and asynchronous added with an interactive component (B, blended learning). In the first learning group the students learned the course only by using WebLI Internet Service. In the second learning group the students used the WebLI Internet Service but they had also real-time meetings with the instructor.

The evaluation form consisted of student self-ratings on 5-point Likert scales. All data was entered into SPSS program for analysis. Statistical analyses were conducted by using t tests, ANOVA-tests, Correlation Coefficient and Regression analysis. New computed variables were formed from the original questions. There were 72 questions of which 10 new variables were formed. The Cronbach's Alphas were between 0.72-0.84.

## **Results:**

Variables "student learning outcomes", "the quality of knowledge", "other students' help", "interaction", "flexibility", and "usefulness" did differ significantly between the two learning groups. There were differences in how students perceived interaction in different groups and these differences had effect on the success in final exams. Students in the group A agreed that the quality of knowledge they got was not so holistic. The experiences and attitudes were overall positive: in group B the experiences were even more positive.

## **Conclusions:**

The particular student learning group and the amount of perceived interaction during the learning, rather than personal characteristics, were better predictors of student outcomes. Interaction is crucial when e-learning. The learning method with an interactive component added was the most effective. Concerning technology issues it was obvious that the easy to use aspect is a "must" for successful e-learning. This is even more important for the female students. Students stated also that Metropolia should increase and promote the use of this kind of e-learning.

## Evaluation: a framework for optometric education and practice

**Lead Author:** Imran A. Khan

Salus University, Pennsylvania, USA and Vision Aid Overseas, UK

### **Purpose:**

Evaluation is an important tool that can be utilised to improve the functioning of an optometric programme. An evaluation can be conducted for different programmes, ranging from evaluating the effectiveness of optometric training programmes to improving service delivery within a private optometric practice. Evaluations can be utilised in both developed and developing world contexts and should be included in the planning and performance review of every programme.

### **Methods:**

Despite the wide variety of uses and contexts that evaluations can be employed in, all evaluations can be conducted using the same basic framework and follow similar steps. In order to determine whether an optometric programme provides quality and effective education and/or service delivery, the implementation and/or outcomes can be evaluated. The Kirkpatrick framework is the most commonly utilised evaluation model, and can be used for this purpose.

Three case studies will be discussed and used to illustrate how the Kirkpatrick framework can be utilised to evaluate different facets of optometric education and practice. The case studies come from both developed and developing world contexts.

### **Results/Data:**

Evaluations follow the same basic framework and can be used to improve the effectiveness of a programme, both in implementation of training and/or service delivery and in overall outcomes. These evaluations can be simple to conduct through understanding the Kirkpatrick framework, as illustrated by the case studies.

### **Conclusions:**

The Kirkpatrick framework is a proven and widely accepted method of evaluation. As evaluations have a key role in improving the effectiveness of optometric education and practice, it is important that optometrists have a basic appreciation and understanding of how an evaluation framework can be utilised.

# Addressing uncorrected refractive error through human resource development: the current situation in Mozambique compared to VISION 2020 targets

**Lead Author:** Stephen Thompson<sup>1,2,3</sup>

**Co-Authors:** James Loughman<sup>1,2</sup>, Prasad Ramson<sup>2,3</sup>, Luigi Bilotto<sup>2,3,4</sup>, Kovin Naidoo<sup>2,3,4</sup>

<sup>1</sup> Dublin Institute of Technology

<sup>2</sup> African Vision Research Institute

<sup>3</sup> International Centre for Eyecare Education

<sup>4</sup> University of KwaZulu-Natal

## **Purpose:**

To compare the current eye care human resources available in Mozambique with desired VISION 2020 targets.

As uncorrected refractive error is now recognised as the leading cause of visual impairment worldwide, and with the increasing longevity of the world's population increasingly compounding the problem, a particular focus is placed on human resources capable of providing comprehensive refractive error services.

## **Methods:**

A national situational analysis of current eye care services in Mozambique was completed, giving an indication of human resources, equipment available and other related indicators. At the time of writing, data had only been validated for six of the 11 provinces of Mozambique (assuming Maputo City is regarded as a separate geographical area to Maputo Province in line with guidance from the National Institute of Statistics). This data was compared to the VISION 2020 targets. Census data was also used to give population levels per province.

## **Results / data:**

The data shows that in all six provinces analysed, there are currently less human resources who can refract available than required. If the VISION 2020 target ratio of one worker skilled in refraction per 50,000 people is to be achieved by the year 2020, an additional 184 workers would need to be trained. Of the 184 workers needed, 69 of these are required for Nampula, Mozambique's most densely populated province.

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**Addressing uncorrected refractive error through human resource development: the current situation in Mozambique compared to VISION 2020 targets**

Province	Population	Current HR	Current Ratio of HR to population (1: x)	Total HR needed by 2010*	Total HR needed by 2020**	HR needed by 2010 (- existing HR)	HR needed by 2020 (- existing HR)
Niassa	1,182,393	8	147,799	12	24	4	16
C. Delgado	1,632,065	3	544,022	17	33	14	30
Manica	1,438,476	5	287,695	15	29	10	24
Inhambane	1,301,967	4	325,491	14	27	10	23
Gaza	1,251,323	4	312,831	13	26	9	22
Nampula	4,049,082	12	337,424	41	81	29	69
<b>Total</b>	<b>10,855,306</b>	<b>36</b>	<b>301,537</b>	<b>112</b>	<b>220</b>	<b>76</b>	<b>184</b>

\*VISION 2020 Target Ratio for 2010 of 1 worker trained to refract per 100,000 people

\*\* VISION 2020 Target Ratio for 2020 of 1 worker trained to refract per 50,000 people

**Conclusions:**

The situational analysis indicates there is a significant shortage of human resources working in eye care in Mozambique and more specifically there is a shortage of workers trained to refract. Further, the distribution of health facilities and the concentration of current human resources in specific urban areas make the current deficit larger than the World Health Organisation recommendations. Further analysis of the geographical distribution of human resources and its impact on access is needed.

The analysis also indicates a shortage of equipment to diagnose refractive error and to correct it through spectacle production. As such, it can be assumed that the burden of uncorrected refractive error in Mozambique currently remains high.



# Keraflex: a new thermal procedure for the treatment of keratoconus

**Presenter:** Richard Corkin

**Lead Author:** Clare Maguire

**Co-Authors:** Maria Galligan, Rebecca McQuaid, Lisa McLoughlin, Arthur Cummings

Wellington Eye Clinic, Dublin, Ireland

## **Purpose:**

Since corneal cross-linking (CXL) received CE approval in 2007 many patients have been treated successfully. The outcomes of CXL have been very satisfactory, with 95% of our patients showing a stabilisation of the keratoconus and the remaining 5% showing a slowing down of their progression. However can we regard success as “locking in” a non-ideal/distorted shape?

Keraflex from Avedro is a new thermal technique that uses microwave energy to improve the overall shape of the cornea, which is followed by accelerated CXL (KXL) to lock in the improved shape. The Keraflex effect would regress completely within three months if no KXL was performed. The aim of this treatment is not only to halt the progression of the ectasia but to both flatten the cornea and stabilize the keratoconus. The purpose of this study is to determine the ideal time interval between Keraflex and KXL.

## **Method:**

three groups of patients who underwent the procedure were analysed. Keraflex was performed on all patients and KXL was performed at different time intervals following their Keraflex treatment. The first group of four patients underwent KXL four to seven days following Keraflex, six months later the second group of four underwent KXL immediately following Keraflex. The final group of six underwent KXL four to six hours following the Keraflex procedure six months later. Their results are analysed by comparing pre- and post-operative topographies and refractions.

## **Results:**

One month, three month and six month outcomes are presented for all three groups. All showed immediate flattening of between 10 to 30 dioptres depending on the amount of energy dialled into the control panel.

Sequential treatments followed by CXL five days later are stable through 12 and 18 months. The eyes treated simultaneously all regressed to baseline at the three month interval even though they looked stable at the one month interval. The eyes treated with CXL five to six hours post-Keraflex looked stable at the one month visit and their six month outcomes will be reported at the meeting.

## **Conclusion:**

Keraflex flattens the cornea very effectively and CXL reduces the natural rebound in shape that occurs after thermal procedures. The timing of the CXL seems to be most effective if CXL is applied after a few hours rather than simultaneously. Results with sequential CXL are already approaching 18 months post-op and appear stable.

# The impact of soft contact lens wear on corneal curvature and thickness and on the outcomes of refractive LASER surgery

**Lead Author:** Aoife Lloyd<sup>1</sup>

**Co-Authors:** Luisa Simo Mannion<sup>2</sup>, Veronica O'Dwyer<sup>1</sup>, Linda Moore<sup>1</sup>

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## Introduction:

A large proportion of corneal refractive surgery (CRS) candidates are previous soft contact lens (SCL) wearers. Accurate pre-operative corneal measurements are crucial prior to CRS to ensure a successful outcome. FDA pre-operative guidelines recommend that SCL wearers cease SCL wear for "at least two weeks before examination and treatment". SCL wear may result in changes to corneal curvature or thickness that may take longer than two weeks to resolve in some cases.

## Purpose:

The purpose of this study was to determine if two weeks cessation of SCL wear was sufficient to allow the cornea to stabilise and explore the possible impact on refractive surgery outcomes.

## Methods:

A retrospective analysis of data and outcomes from LASIK or LASEK patients, between a group of SCL (SCL: n=45); and non-contact lens wearers (NCL: n=45). Corneal shape and thickness parameters were measured using the Pentacam (Oculus, Germany). Curvature and thickness measurements were compared before and after cessation of SCL wear. Surgery outcomes were compared by analysing unaided vision and accuracy of refractive correction.

## Results:

Preliminary outcomes showed no significant differences in keratometry or axial curvature between the SCL and NCL groups. However, tangential curvature showed inferior steepening for the SCL group (SCL vs. NCL;  $7.77 \pm 0.30$  mm vs.  $7.90 \pm 0.30$ mm;  $p= 0.042$ ). Central and nasal corneal thickness were increased in the SCL group following cessation of SCL wear (SCL vs. NCL:  $6.30 \pm 8.38\mu\text{m}$  vs.  $4.64 \pm 10.60\mu\text{m}$  thinner,  $p= 0.028$ ). Improved vision in the SCL group was found for those patients who had a LASEK procedure (SCL vs. NCL: 6/5 vs. 6/5-2,  $p= 0.031$ ), a result that was statistically but not clinically significant.

## Conclusions:

While SCL wear does appear to have an influence on corneal measurements, it does not appear to have a negative implication for outcomes of refractive surgery procedures.

# Scleral contact lenses improve visual acuity and contact lens tolerance of keratoconus patients

**Presenter:** Philip Fine

**Co-Authors:** Steven Jackson, Renana Halperin, Esther Lebovich, Ayelet-Chen Lahav, Liat Gantz and Ariela Gordon-Shaag

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## **Purpose:**

Four patients with progressive keratoconus (KC) who were unable to tolerate any form of traditional KC contact lenses (including piggy back) and a legally blind post penetrating keratoplasty astigmatic patient, were fitted with novel gas-permeable scleral (GPS) contact lenses.

## **Methods:**

The lenses were made of Boston XO material, with a DK of 100, 0.4 mm central thickness, 23.5 mm and 21 mm diameter, polish-free, with a unique aspheric back optical surface, and an eccentricity of 0.40 to minimize higher order wavefront aberrations.

## **Results/Data:**

The GPS lenses significantly improved visual acuity (VA) and quality of life outcomes for the patients:

- Patient I (age: 24, KC diagnosed age 20) presented with 6/120 vision in the right eye and counting fingers (CF) at 1.5 meters in the left eye, and achieved 6/9 VA in each eye with the GPS lenses.
- Patient II (age:50, KC diagnosed age 18) presented with CF at 1 meter in the right eye, and 30 cm in the left eye, and reached a VA of 6/15 in the right eye, 6/15+ in the left eye, and 6/12+ binocularly with scleral contact lenses.
- Patient III (age: 49, KC diagnosed age 23, with complaints only in the left eye) with CF at 40 cm in the left eye, reached 6/6- VA with a GPS lens.
- Patient IV (age: 64, KC diagnosed age 23) with 6/30 vision in the right eye and CF at 2 meters in the left eye, reached 6/6 vision in the right eye and 6/6- in the left eye with the GPS lenses.
- Patient V (age: 60, KC diagnosed age 17, 1985 graft for left eye, 1986 graft for right eye, 1994-1995 relaxing incisions in each eye and compressing sutures in the left eye to reduce the astigmatism that had reached up to 11 DS) presented with two pairs of spectacles to correct the 21 DS against the rule astigmatism correction in the two eyes. The VA of 6/9 in each eye with the “double spectacles” was improved to 6/5 with the GPS lenses. The lenses can be worn comfortably for many hours (10, eight, 12, 12 and 13 hours respectively).

## **Conclusions:**

Scleral contact lenses can improve visual acuity outcomes and hours of contact lens wear for KC patients that cannot tolerate other forms of contact lenses.

## **Conflict of Interest:**

Philip Fine is a past consultant for Soflex Contact Lenses, LTD, manufacturer of the scleral contact lenses used in this study. Soflex provided the lenses used in this study, free of charge.

## Factors associated with adjustment to visual loss

**Lead Author:** Keziah Latham

**Co-Author:** Daryl R. Tabrett

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Anglia Ruskin University, Cambridge, UK

### **Purpose:**

Visual loss is a form of bereavement, with significant potential impact on psychological health. Adjusting to life with acquired visual loss requires people to alter and develop capabilities that are compatible with their personal resources. Therefore, understanding the factors related to adjustment could help to identify people likely to struggle to adapt to visual loss, and to suggest methods of supporting people coming to terms with visual loss. The project set out to determine the visual and psychosocial factors predicting levels of adjustment to visual loss as assessed with a validated questionnaire concerned with acceptance and self-worth aspects of adjustment.

### **Methods:**

One hundred people with vision loss affecting their daily lives participated. Adjustment to visual loss was assessed with the AS-WAS questionnaire. Dependent variables assessed were age, gender, duration of visual impairment, number of co-morbidities, distance visual acuity, contrast sensitivity, reading function, visual fields, social support (Interpersonal Support Evaluation List: ISEL), depression (Geriatric Depression Scale: GDS), and personality (5-factor model; NEO-FFI).

### **Results:**

Higher AS-WAS scores, indicating better adjustment, were significantly predicted in stepwise multiple regression by lower neuroticism ( $\beta$  -0.33,  $p < .001$ ), lower depression ( $\beta$  -0.35,  $p < .001$ ), higher conscientiousness ( $\beta$  0.31,  $p < .001$ ), higher levels of education ( $\beta$  0.16,  $p < .05$ ) and better contrast sensitivity ( $\beta$  0.16,  $p < .05$ ). The regression model accounted for 57% of variance in AS-WAS scores.

### **Conclusions:**

Treating depression is important in assisting people in adjusting to visual loss. Aspects of personality (neuroticism, conscientiousness) may be less modifiable, but could help identify who is most likely to have problems adjusting to vision loss. Note that duration of vision loss, and to a large extent level of visual loss, were not significant in predicting adjustment. Further research to determine the longitudinal course of adjustment would be valuable.

# Prognostic indicators and outcome measures for patients with neovascular age-related macular degeneration undergoing treatment with intravitreal ranibizumab

**Lead Author:** Sarah Sabour-Pickett<sup>1,2,3</sup>

**Co-Authors:** James Loughman<sup>1,4</sup> John Nolan<sup>2,3</sup>, Jim Stack<sup>3</sup>, Konrad Pesudovs<sup>5</sup>, Stephen Beatty<sup>2,3</sup>

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## Objectives:

To assess visual function, and its response to serial intravitreal ranibizumab, in patients with neovascular age-related macular degeneration (nv-AMD), and explore whether alternative psychophysical tests are more appropriate prognostic indicators and/or outcome measures than corrected distance visual acuity (CDVA) for patients with this condition.

## Methods:

Forty seven eyes of 47 patients with nv-AMD (with CDVA LogMAR 0.7 or better) undergoing monthly intravitreal ranibizumab therapy were enrolled into this prospective study. Visual function was assessed using a range of psychophysical tests and by a questionnaire, while mean foveal thickness (MFT) and mean foveal volume (MFV) were determined by optical coherence tomography (OCT), all at monthly intervals in patients undergoing monthly serial intravitreal injections of ranibizumab.

## Results:

Group mean ( $\pm$ sd) MFT reduced significantly from baseline (233 [ $\pm$ 59]) to exit (205 [ $\pm$ 40]) ( $p=0.001$ ). Visual acuity and questionnaire scores exhibited no change between baseline and exit visits ( $p=0.48$  and  $p=0.31$  respectively). Measures of visual function that did exhibit statistically significant improvements ( $p<0.05$  for all) included: mean reading speed, mesopic contrast sensitivity (CS) at low and high spatial frequencies, mesopic glare disability (GD) at low and medium spatial frequencies, and retinotopic ocular sensitivity (ROS) at all eccentricities. The reduction in MFT was significantly related to observed improvements in the following parameters of visual function: ROS at all eccentricities ( $r=0.41-0.59$ ;  $p<0.01$  for all); mesopic GD at low and high spatial frequencies ( $r=0.34-0.35$ ;  $p<0.05$  for all) and CDVA ( $r=-0.31$ ;  $p=0.04$ ). Furthermore, baseline CDVA, and in particular baseline ROS at fixation and within the central  $5^\circ$ , demonstrated a capacity to positively predict the degree of change in MFT over the study duration ( $r=0.35-0.49$ ;  $p<0.05$  for all).

## Conclusion:

Eyes with nv-AMD undergoing monthly intravitreal ranibizumab injections exhibit improvements in many parameters of visual function. It appears that CS under mesopic conditions at low and high spatial frequencies, mean reading speed, GD at low spatial frequencies and ROS would be more sensitive outcome measures than CDVA for patients undergoing this treatment, at least in eyes where baseline CDVA is logMAR 0.7 or better.

## Macular pigment – focus on vision

**Lead Author:** James Loughman

Optometry Department, School of Physics, College of Sciences & Health,  
Dublin Institute of Technology, Ireland

### **Purpose:**

Macular pigment (MP), composed of the dietary xanthophylls lutein, zeaxanthin and meso-zeaxanthin, is known to have optical and antioxidant properties that have the potential to affect visual performance and/or ocular health. In recent times, researchers have proved singularly focussed on the potential impact of MP for ocular disease, typically age related macular degeneration (AMD).

### **Methods:**

Numerous psychophysical tests and visual performance questionnaires have been designed and used to assess the impact of MP on ocular disease and visual function. An online survey has also recently been conducted to assess the pattern of MP supplementation and its relationship with AMD in the UK and Ireland. This study provides an overview of the evidence to suggest that the ultimate role of MP is for vision, not simply disease.

### **Results:**

Optometrists in the UK and Ireland appear to recommend MP supplements to persons either at risk of or previously diagnosed with AMD. There is an apparent lack of appreciation of the full body of scientific literature that shows the beneficial effects of MP on aspects of vision including visual acuity, glare disability, photostress recovery, contrast sensitivity, and critical flicker fusion frequency among others.

### **Conclusions:**

As optometrists are focussed on the enhancement of vision through optical means (by using spectacle lenses, contact lenses, optical and polarising filters, anti-reflection coatings etc), it is perhaps surprising that the profession has not engaged with the optical importance and benefits of MP for vision in healthy individuals of all ages. While the increasing prevalence and associated burden of AMD are important for optometric practice, it is, perhaps, important to ensure that practitioners do not lose sight of the fundamentals of vision science and optometry. In this context MP is an optical filter, it provides benefits for vision, it can be used to optimise visual performance and experience in younger healthy individuals, and also to preserve that visual integrity into older age when ocular disease becomes prevalent.

# The perception of depth by simultaneous sectional suppression and retinal dominance (SSSRD)

**Lead Author:** Roger S. Anderson<sup>1</sup>

**Co-Author:** John F. Price<sup>2</sup>

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<sup>2</sup> Vision Science Research Group, University of Ulster, Coleraine, UK

## **Purpose:**

In conventional binocular theory, objects falling outside of the fixation point in both eyes are only perceived as single within Panum's fusional area, and stereo depth is derived from the small retinal disparities between these points close to the horopter. However, recent theories, conducted under natural viewing conditions have proposed that the binocularly overlapping visual fields of each eye are divided into four sectional areas, two behind and two in front of the fixation point and separated by the visual axes. Under natural viewing, each of these sectional areas is perceived only by one eye at any time, the corresponding section in the other eye being simultaneously suppressed. The subsequent alignment of the visual axes within the cortex eye allows the depth relative to the fixation point to be extracted. This system has been coined Simultaneous Sectional Suppression and Retinal Dominance (SSSRD; Price, 2009). We sought to test this theory by recording the reported binocular viewing experience of a group of young naïve observers while viewing a natural scene.

## **Methods:**

Twenty three naïve observers, with normal binocular vision, aged 16-23, were asked to fixate on a distant point in a natural scene with both eyes open. Targets (pencils) were introduced to the right and left of fixation at distances much closer than the fixation point. While maintaining distant fixation, and with both eyes open, subjects were asked how many pencils they saw. While continuing to maintain distant fixation, subjects were asked to separately close right or left eye in turn and report with which eye each of the near targets was aligned.

## **Results:**

Of the 23 subjects, only one was unable to understand the task or reliably record how many near targets could be seen. Of the other 22 subjects, all observed only two targets while fixating on the distant object. The same 22 subjects all reported the near object on the right to be aligned with the right eye and the near object on the left to be aligned with the left eye.

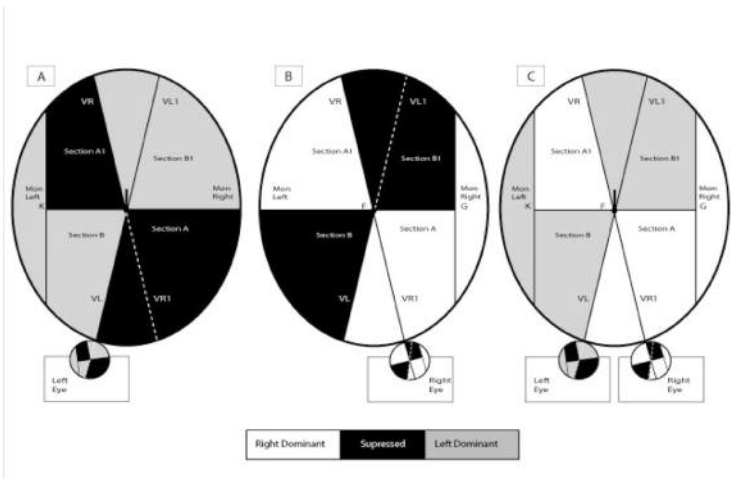
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**The perception of depth by simultaneous sectional suppression and retinal dominance (SSRD)**

**Conclusions:**

Our findings appear to support the hypothesis of SSSRD, in that diplopia is not observed for objects located in front of the fixation point under natural binocular viewing conditions in a large number of normal observers. Near targets lying on the right and left side of the visual axis are only perceived by the right and left eye respectively, the retina appearing to suppress the image from the opposite side.

**Figure:** The framework structure of the visual fields for a right-eye dominant observer, showing the different sectional areas.





# Effect of optical defocus on detection and recognition of vanishing optotype letters in the fovea and periphery

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## **Purpose:**

Vanishing optotypes (VOs) are pseudo high-pass letters whose mean luminance matches the background so that they 'vanish' when recognition acuity threshold is reached in the fovea. This study determined the effect of increasing blur on acuity for these optotypes and conventional letters, in both foveal and extrafoveal viewing.

## **Methods:**

Detection and recognition thresholds were determined separately for each of the 26 letters of both a conventional and VO alphabet, both in the fovea and at 10 degrees in the horizontal temporal retina, under varying degrees of positive dioptric blur.

## **Results:**

In the fovea, detection and recognition thresholds were similar for individual VOs, increased steadily with blur, and separated somewhat at higher levels of defocus (3D). While the recognition thresholds for VOs changed on average by 0.28 logMAR/dioptre, those for conventional letters changed more rapidly by 0.35 logMAR/dioptre. At 10 degrees in the periphery, recognition thresholds were significantly higher than detection thresholds for the 'vanishing' optotypes at OD blur; both thresholds increased steadily thereafter, converging as blur increased. Unlike in the fovea, peripheral recognition acuity displayed a loss of only 0.09 logMAR/dioptre. In both the fovea and periphery, the inter-letter variation in recognition acuity was much lower for VOs than conventional letters (0.04 vs. 0.09 logMAR).

## **Conclusions:**

Outside in the fovea, high-pass 'vanishing' optotypes display significant differences in their detection and resolution thresholds, this difference remaining up to +7D blur, with a logMAR/dioptre loss of only about a quarter of that observed in the fovea. The lower inter-letter legibility differences indicate that VO letters may be better stimuli from which to design clinical letter charts.

## Accommodative accuracy with printed text vs. hand-held computer gaming

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<sup>2</sup> Vision and Eye Research Unit, Postgraduate Medical Institute, Anglia Ruskin University, UK

### **Purpose:**

Accommodative accuracy and the after effects of prolonged accommodation (near-induced transient myopia or NITM) have been quantified for different types of reading task or varying cognitive demand. In recent years the use of hand-held computing devices and mobile phones for gaming and web browsing has increased dramatically. The effects that such devices might have on accommodative responses is as yet unknown although closer working distances have been reported.

### **Methods:**

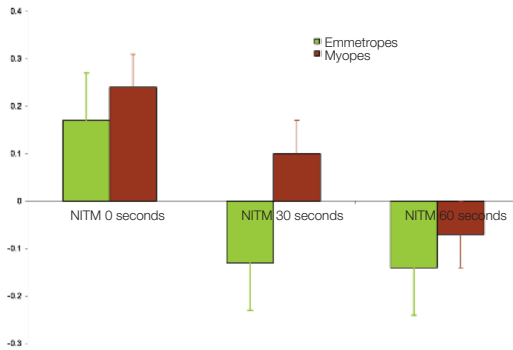
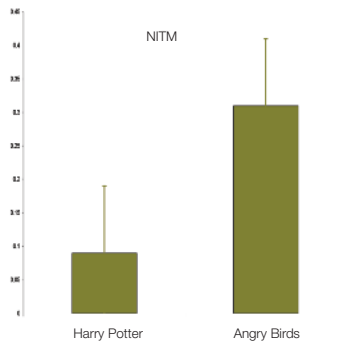
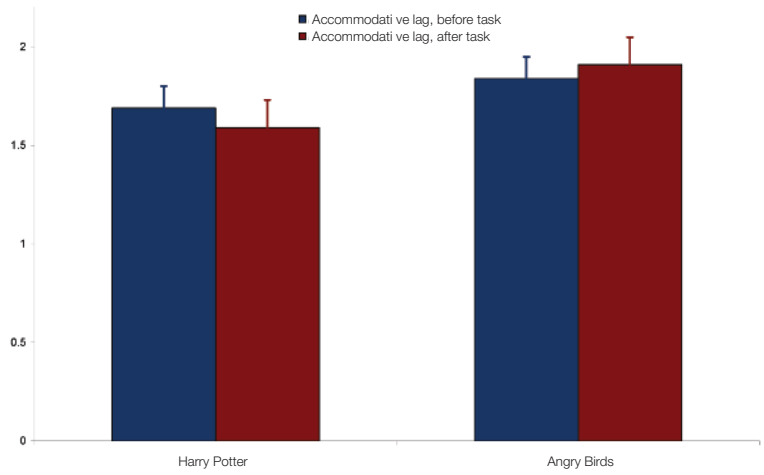
Accommodative responses for near and far viewing were measured using the Shin Nippon SRW5000 open-field auto-refractor before and after a 10 minute near task at 20 cm in ten myopes and ten emmetropes. Accommodative lag for near and lead for far (NITM) was calculated. Subjects were first dark adapted for five minutes. The 10 minute near task consisted of either: i) reading printed text of N12 size, black on white, printed on A4 paper (an excerpt from a 'Harry Potter' novel) or; ii) playing the 'Angry Birds' computer game presented on an iPhone display. The tasks were viewed binocularly with any refractive error correction in place and were undertaken on different days and in a random order.

### **Results:**

Accommodative lag was not significantly different between tasks (one-way ANOVA: P.0.2) either before or after, but was slightly higher for Angry Birds (Figure 1). NITM was also not significantly between tasks (one-way ANOVA:  $p>0.1$ ) but was higher for Angry Birds (Figure 2). There was a significant difference in the duration of NITM in myopes vs. emmetropes (one-way ANOVA:  $F=5.828$ ;  $p=0.021$ ) with myopes showing more persistent effects (Figure 3).

### **Conclusions:**

The lower accommodative response during the gaming task may result from either a difference in the spatial structure of the targets viewed or differences in the cognitive demand for reading versus gaming. This has clinical implications because of the role of retinal defocus in stimulating myopia development and progression. As there is increasing use of such hand-held devices further research into the visual systems response to hand-held computing devices and mobile phone displays is needed.



## The effect of astigmatic blur orientation on different alphabets

**Lead Author:** P.M.Serra

**Co-Authors:** M.J.Cox, C.M.Chisholm

<sup>1</sup> University of Bradford, Bradford School of Optometry and Vision Science, Bradford, UK

### **Purpose:**

The ability of pseudophakic patients to show functional levels of vision for distance and near tasks has been attributed to several post-operative ocular characteristics. One of these advanced features is refractive astigmatism in its against-the-rule form, benefiting from the predominant directionality of reading material, when Roman letters are used. The aim of this study was to evaluate the effect of astigmatic blur orientation on letter discrimination using the Roman alphabet and three others.

### **Methods:**

Visual acuity (VA) was measured in 24 participants (median age = 23.0 y/o [19-51]), with mean refractive error ( $SE = -0.58 \pm 2.54DS$ ), using four different alphabets Arabic, Chinese, Roman and Tamil (Indian). Four different conditions were tested: an in-focus, and three astigmatic conditions. The latter were optically induced with a +2.00 DC lens oriented at 180, 45 or 90 degrees. The subjective refraction, the blur lens and a 3.0 mm artificial pupil were mounted in a trial frame and measurements performed monocularly. Ten VA levels, with five letters per level, ranging from 0.7 to -0.2 logMAR, were presented individually, at 4.0 m viewing distance and presented on a LCD monitor. Letter identification was made using a Sheridan-Gardiner VA type task.

### **Results:**

With the same optical correction, visual acuity measured using the different charts made from different alphabets provides a range of VA scores. Participants showed the highest discrimination for the Roman characters, whereas the Tamil characters produced the lowest VA scores. The Arabic and Chinese alphabets with similar levels of letter discrimination, had results between the Roman and Tamil alphabets. For all four alphabets oblique astigmatism (+2.00 x 45 DC) was responsible for the highest visual degradation compared to the in-focus condition. The horizontal blur condition (+2.00 x 90 DC) was next and vertical blur (+2.00 x 180 DC) produced the smallest degradation. All alphabets had statistically significant differences between VA measured with oblique and vertical defocus, but significant differences between the oblique and horizontal blur was only found when Arabic letters were used. For the remaining three alphabets, although VA measurements in the presence of vertical blur were higher than those obtained with horizontal blur, the differences were not statistically significant.

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## **The effect of astigmatic blur orientation on different alphabets**

### **Conclusions:**

Letter discrimination depends upon both the alphabet used and the blur induced as well as their interaction. VA differences may be explained by two main factors. Firstly, the participants' familiarisation with the characters, explaining the higher VA found with the Roman letters. Secondly the letters' complexity, that leads to the lowest VA for the Tamil alphabet. The similarity in terms of letter complexity of the Arabic and Chinese characters may explain why the results for these two alphabets were close. The possible benefit of astigmatic blur as a source of pseudoaccommodation may be extended from Roman to other types of alphabets such as Arabic and Chinese. However in the case of highly complex letter types such as the Tamil characters, any type of orientation blur may compromise letter discrimination.

## Suitability of conventional typographies to measure visual acuity

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**Co-Authors:** Héctor Abril, Aurora Torrents

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### **Purpose:**

Most near vision reading charts include the visual acuity values. On the one hand, commonly, such reading charts are constructed using the Times New Roman typography. On the other hand visual acuity, in its pure sense, has to be measured with optotypes rather than with typographies. In this paper, an objective analysis by image processing of the stroke width of some typographies (Times New Roman, Arial, Arial Bold, Sloan and Optotipica), suitable to be used in acuity and near vision reading charts, is performed.

### **Methods:**

Taking the tumbling E as the optotype model, two new parameters were defined, for each typography: the Optotypicalness and the Spread. The software used for type image generation was ImageMagick. A binary correlation was performed to quantify the stroke width and spacing of each character. Optotypicalness expresses the normalized number of times that thickness equal to one fifth of total height is included in the image. Spread gives the variability of the stroke width. An optotype such as tumbling E and Landolt ring have Optotypicalness = 1 and Spread = 0.

With the goal of following the design philosophy of optotypes, we created the font Optotipica, which is a True Type font suitable for any software system supporting Open Type fonts (Figure 1). It contains the Latin Basic encoding with lining figures and all the diacritics used in Western Europe, that is, it includes upper and lower-case letters and numerals. A first version of our font can be reached at <http://hdl.handle.net/2099.3/34979> and used without permission for research purposes.

### **Results:**

Figure 2 displays the Optotypicalness (a) and the Spread (b) of upper case, lower case and numerals of the typographies considered.

### **Conclusions:**

None of the conventional typographies analysed are suitable to do visual acuity measurements, with Times New Roman being the worst and Arial Bold the best. Sloan and Optotipica fonts scored the highest in performance although the Sloan font contains only uppercase letters.

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**Suitability of conventional typographies to measure visual acuity**

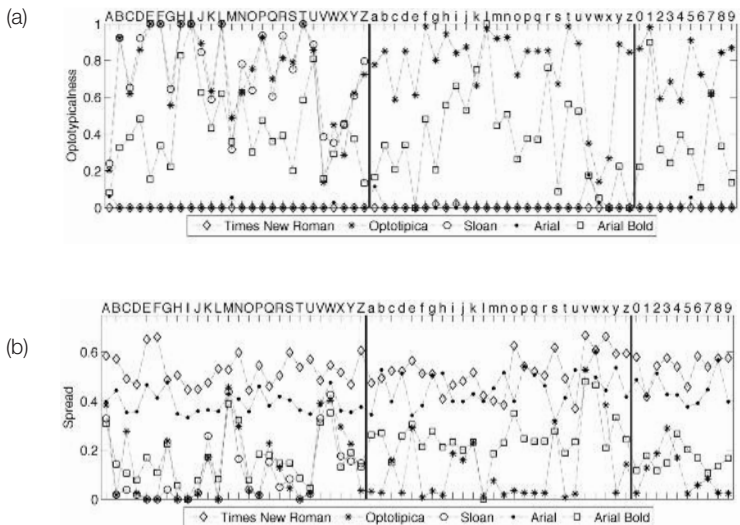
Figure 1: Optotipica typography

**ABCDEFGHIJKLMN**  
**OPQRSTUVWXYZ**

**abcdefghijklmn**  
**opqrstuvwxyz**

**1234567890**

Figure 2: Optotypicalness (a) and Spread (b) of the typographies considered.



## Poster Presentations

### An investigation of the effect of head position when assessing dissociated and associated heterophoria

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**Co-Authors:** Rachel North<sup>2</sup>, Christine Purslow<sup>2</sup>, Fergal Ennis<sup>2</sup>

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#### **Purpose:**

The importance of head position in the assessment of ocular motility is widely acknowledged, but the significance of head position in other binocular vision is not fully understood. This study aimed to examine the effect of angle of gaze on dissociated (DP) and associated heterophoria (AP), using angles typically found in the average person's working day. It was anticipated that any change found could be of occupational and clinical relevance.

#### **Methods:**

Eighty-nine subjects (32M, 57F; age 22.3±4.5yrs) took part in the study to examine the effect of a 15° change in angle of gaze on DP and AP. A second group of sixty-two subjects (20M, 42F; age: 22.1±3.9yrs) was recruited to examine the effects with 30° change in angle of gaze. The inclusion criteria consisted of monocular acuity of 0.1 or better, absence of asthenopic symptoms; ortho or low heterophoria, and at least 60" stereoacuity. Horizontal DP was measured using the Saladin card and Tangent Screen at near and distance respectively. AP was measured using the Mallett Unit at near and distance, and repeated measures ANOVA was used to compare deviations with angle of gaze. All subjects provided written informed consent; this study conformed to the tenets of the Helsinki declaration.

#### **Results:**

**Distance:** Compared to the primary position significant changes were found in DP horizontally and vertically. Post-hoc testing revealed that DP became significantly more eso in right and left gaze to 30° ( $p < 0.005$ ). Upon elevation to 15° there is a significant decrease in esophoria ( $p = 0.04$ ), and a significant increase in eso-deviation upon depression to 30° was observed for both the DP ( $p = 0.005$ ) and AP ( $p = 0.02$ ).

#### **Near:**

Significant changes were only found on elevation. There was a significant increase in exo DP at 15° and 30° ( $p = 0.000$ ), and a significant increase in exo AP at 30° ( $p = 0.02$ ).



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### **An investigation of the effect of head position when assessing dissociated and associated heterophoria**

#### **Conclusions:**

Reasons for these differences with distance fixation are probably anatomical rather than affected by any accommodative element; the evidence for the presence of some proprioception in the orbit or neck that stimulates accommodative convergence even when looking in the distance is unclear. For the eye care professional, this indicates that they should be particularly aware of patients who may raise their chin to look at a distance Mallet Unit – the result will have a tendency to be recorded as more esophoric (less exophoric) if this is not corrected, although potentially the change will be small (on average less than  $0.5\Delta$ ).

## Central corneal thickness obtained by ultrasound and noncontact specular microscope with and without anaesthesia

**Lead Author:** Abdulaziz Alkathiri

**Co-Author:** Saud Alanazi

Department of Optometry, College of Applied Medical Sciences,  
King Saud University, Riyadh, Saudi Arabia

### **Purpose:**

To compare central corneal thickness (CCT) values obtained with and without tetracaine 1% using ultrasound pachymetry (USP) and Topcon SP-3000P specular microscope.

### **Methods:**

CCT measurements were obtained from 100 randomly selected eyes of 50 oculo-visually young adults in two measurement sessions in the order of SP-3000P before anaesthesia, followed by USP before anaesthesia, SP-3000P 10 minutes after anaesthesia and USP 10 minutes after anaesthesia.

### **Results:**

Within session for each technique and between session for each technique, the central corneal thickness obtained before instilling anaesthesia did not vary significantly ( $p > 0.05$  for both techniques). Baseline central corneal thickness measurements obtained by USP was significantly ( $P < 0.0001$ ) higher than that of SP-3000P by about  $28\mu\text{m}$  and  $29\mu\text{m}$  in sessions one and two respectively. A statistically significant increase in CCT ( $p < 0.05$ ) was obtained by USP 10 minutes after instilling one drop of 1% tetracaine in sessions one but not in session two. A small decrease in CCT was observed in both sessions of SP-3000P 10 minutes after instilling local anaesthesia which was not statistically significant ( $P > 0.05$ ). For sessions one and two, the precision of the effects of anaesthesia in both techniques were  $\pm 15\mu\text{m}$  and  $\pm 31\mu\text{m}$  for USP,  $\pm 16\mu\text{m}$  and  $\pm 13\mu\text{m}$  for SP-3000P respectively.

### **Conclusion:**

Topical anaesthesia had no measurable effect on CCT measurements obtained by noncontact specular microscope but appears to have affected measurements obtained by ultrasound Pachymeter. Such an effect could be due to tear film instability mediated by the anaesthetic agent. The difference in the operating principles of both pachymeters may also have played a significant role in the detection of changes in CCT induced by topical anaesthesia.

# Diabetes, there is more to it than the eye

**Lead Author:** Carolien A. Antonius

**Co-Author:** Janna M. Brouwer

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**Purpose:** The major chronic complications of diabetes include the microvascular complications of nephropathy, retinopathy, and neuropathy and the macrovascular complications of cerebrovascular disease, ischemic heart disease, and peripheral vascular disease.

Since diabetic patients are screened regularly for diabetic retinopathy it would be interesting to see if retinopathy could be used as a predictor for other diabetic complications.

**Methods:** A literature review was undertaken to determine the interrelationship between the different diabetic complications. Both clinical trials and observational studies were taken into consideration.

**Results:** In several studies associations between diabetic retinopathy and other diabetic complications have been found. Abu El-Asrar et al. found that retinopathy was an independent predictor for nephropathy (IDDM, OR=8.02, 95% CI=1.95-33; NIDDM, OR=2.48, 95% CI=1.02-6.03).

For the cardiovascular complications retinopathy was found to be a predictor as well. Cheung et al. found that patients with diabetic retinopathy are at a higher risk to develop a fatal coronary heart disease (HR=3.35, 95% CI= 1.40-8.01). Liew et al. found a similar association (HR=2.21, 95% CI=1.20-4.05). Cheung et al. found that those with retinopathy have higher risk of developing ischemic stroke (HR=2.34, 95% CI=1.13-4.86). Grauslund et al. looked into the overall mortality rate associated with diabetic retinopathy, the presence of proliferative retinopathy gave a higher risk when compared with non-proliferative retinopathy (HR= 2.04, 95% CI=1.43-2.91 vs HR=1.01, 95% CI=0.72-1.42).

**Conclusion:** It was found that nephropathy, cardiovascular complications and mortality can be predicted by the presence of retinopathy.

To lower the economic burden of diabetic complications it would be desirable to develop a scoring system that can predict the development of diabetic complications. The role of the optometrist would not only be to screen for retinopathy, but also to keep the whole patient in focus.

## Biomechanical changes in corneas with keratoconus after implantation of two types of intracorneal rings

**Presenter:** Mar Argudo Iturriaga<sup>2</sup>

**Lead Author:** Cristina Peris Martínez<sup>1</sup>

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### Objective:

Corneal elasticity and rigidity are altered in eyes with keratoconus (KC). This is due to an anomalous distribution of stromal collagen fibrils in these patients.

Several studies published in the literature support the efficacy of intrastromal rings and are considered a good option to delay corneal transplantation in patients with this disease. The behaviour of corneal tissue in the KC is not completely understood, since there are no validated methods to quantify it clinically in patients. Therefore this study analysed biomechanical factors before and after implantation of intrastromal corneal rings Keraring<sup>®</sup> 5 and 6 mm in diameter in keratoconic corneas.

### Methods:

Biomechanical properties were studied in 40 eyes of 34 patients with KC. These patients underwent surgery to insert intrastromal rings Keraring<sup>®</sup> 5 and 6 mm in diameter, surgery which was customised for each patient's needs.

This created four groups of 10 eyes each: one implanted with two rings of 6mm diameter, one with two rings of 5mm diameter, one with a ring of 6mm and the last with a ring of 5mm diameter. The rings used were triangular section and 0,6 flat base for 5mm (isosceles triangle) and 0.8 to 6mm (scalene). A femtosecond laser (IntraLase<sup>®</sup>) was used.

Biomechanical factors studied using an Ocular Response Analyzer (ORA) (Reichert, Depew, NY) were: corneal hysteresis (CH) and corneal resistance factor (CRF), before and six months after implantation.

### Results:

CH preoperative values were  $8,48 \pm 2,34$  and CRF preoperative values were:  $7,83 \pm 2,68$ . Group two rings 5mm: postoperative CH and CRF mean values were  $9,65 \pm 1,94$  (p.0, 06) and  $8,54 \pm 2,5$  (p.0, 22) respectively. Group two rings 6mm: CH  $8,59 \pm 1,99$  (p.0,44)y CRF  $7,49 \pm 1,73$  (p.0,31). Group 1 ring 5mm: postoperative mean values CH and CRF were  $8,75 \pm 0,87$  (p.0,28)y  $7,4 \pm 0,92$  (p.0,2) respectively. Group 1 ring 6mm: CH  $9,85 \pm 1,62$  (p.0,02)y CRF  $8,17 \pm 1,45$  (p.0,3).

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### **Biomechanical changes in corneas with keratoconus after implantation of two types of intracorneal rings**

#### **Conclusion:**

The study found an increase in CH in either case, as expected, although only statistically significant for implant 1 ring 6mm, contradicting the theory that the smaller the diameter of the implant, the more you concentrate the effect on the apical optical area.

It proves to be a parameter that is independent from variations in the central corneal thickness. The resistance factor, CRF, again demonstrates corneal thickness-dependent variations.

A greater number of subjects implanted with these intrastromal rings, as well as longer-term studies would be required to provide more information about corneal changes after the longer term use of this therapy.

## Morning to afternoon osmolarity changes among silicone hydrogel contact lens and non-contact lens wearers

**Lead Author:** Jan Bergmanson

**Co-Authors:** William Miller, Norman Leach, Cristina Polizzi, Ryan Dimit

University of Houston, College of Optometry, Texas Eye Research and Technology Centre, USA

### **Purpose:**

The current study compared tear osmolarity changes throughout the day between different silicone hydrogel (SiHy) materials and a non-contact lens wearing (NCL) control group.

### **Methods:**

Twenty-six subjects were enrolled and divided into a contact lens and non-contact lens wearing group. The contact lens group was further subdivided equally by material. Study was approved by the Committee to Protect Human Subjects at the University of Houston. Contact lens subjects filled out a contact lens comfort and care system questionnaire. Subjects were instructed to apply lenses straight from package one hour prior to first measurement. Tears were analyzed from the tear meniscus at the lateral canthal lower lid margin using the TearLab system. The initial eye chosen for measurement was randomized. The second measurement was taken in the afternoon, a minimum of seven hours after the initial morning measurement. Resultant data was analyzed using the statistical program SPSS.

### **Results/Data:**

No differences were found between eyes in either the morning or afternoon measurement. NCL subjects showed a very slight increase from morning to afternoon of 1.4 mOsm. Lotrafilcon B (CibaVision, Air Optix) and Comfilcon A (CooperVision, Biofinity) subjects had a significant decrease in osmolarity during the day of 6.4 mOsm and 8.5 mOsm respectively. Senofilcon A (Vistakon, Acuvue Oasys) showed a significant increase of 6.0 mOsm from morning to afternoon. No difference was demonstrated between contact lens and non-contact lens wearers. A Pearson correlation showed no statistical association between osmolarity and contact lens comfort.

### **Conclusions:**

Our data showed that each type of lens type studied had variable effects on tear osmolarity. Two of the SiHy's (Lotrafilcon B and Comfilcon A), showed a decrease in osmolarity from the morning to afternoon. Whilst another SiHy (Senofilcon A) demonstrated an increase in osmolarity over the same timeframe. We hypothesize that tear osmolarity differences may be due to the way in which each contact lens material seeks to enhance its wettability. Silicone, inherently hydrophobic, is countered by manufacturers using different methods to shield it and make it wettable. Thus, it would appear that the different methodologies may influence tear osmolarity. It may well then be argued, that in patients with an afternoon dry eye complaint, a lens lowering the osmolarity might be a more preferred choice.

# Fitting a hand-painted iris aphakic gas permeable contact lens

**Lead Author:** David Berkow

Optometrist, Haifa, Israel

## **Background:**

The patient was wounded in the eye by a penetrating piece of shrapnel. The shrapnel damaged his iris and caused a traumatic cataract. After recovering from the cataract extraction he was referred to the author to be fitted with an optical correction.

## **Case Study:**

The vision of the non-damaged eye was 6/6 but the damaged eye needed a correction of +15.00D (there was no lens implant). Spectacle correction was not an option. The other problem was the damaged iris. The iris aperture was very large and the iris could not constrict.

The patient was fitted with a Gas Permeable contact lens with a correction of +15.00. But to give visual acuity of 6/6 he needed a pin hole. Therefore the final lens fitted had the Rx. correction of +15.00D.

The lens had an iris painted on it to match the iris of the non-damaged eye and the clear "pupil" on the lens had a diameter of 3.5mm, thus giving the effect of a normal pupil.

## Albinoidism: diagnosis and treatment

**Lead Author:** Marie I. Bodack

Cincinnati Children's Hospital, Cincinnati, USA

**Purpose:**

To report on the condition of albinoidism, including diagnosis and treatment options.

**Methods:**

A 10 year old Caucasian male was referred by his paediatrician to rule out albinism due to fair hair pigmentation. He reported problems seeing in the distance in brightly lit environments.

Uncorrected visual acuity was 20/30 (6/7.5) OD, 20/40 (6/12) OS. No strabismus or nystagmus was present. Refraction revealed -0.50+0.50x75 OD (20/20-2, 6/6-2) and -0.50+0.75x120 OS (20/30, 6/7.5). Slit lamp examination revealed iris transillumination defects. Colour vision was 15/15 each eye (Ishihara). Randot stereopsis was absent. Dilated examination revealed foveal hypoplasia. The patient was prescribed glasses with tinted lenses to help with glare. He was suspected of having a mild form of oculocutaneous albinism (OCA) due to the absence of nystagmus and excellent visual acuity. The patient was referred to genetics and a retinologist for additional testing.

The retinologist felt that the patient had a form of OCA. An OCT revealed a lack of the foveal depression. The results of the genetic testing were negative for overt X-Linked and OCA Types 1,2,3,4, but other mutations could not be ruled out. Due to these results, the excellent VA and the absence of nystagmus, the patient was felt to have albinoidism.

At his exam, one year later, the patient's mother reported a history of ocular albinism in her cousins. The patient's visual acuity, refraction and retinal appearance were stable. The patient was now playing soccer and reported difficulties seeing in bright sunlight with and without the glasses. It was felt that the symptoms were due to ocular straylight from the iris transillumination defects. The patient was referred for a custom contact lens fitting and a custom tinted contact lens with black underprint, to decrease the photophobia, was ordered.

The discrepancy between the visual acuity in the right and left eyes could be due to greater foveal hypoplasia in the left eye or to a microtropia. Additional binocular testing will be performed at a future visit.

**Conclusions:**

Traditionally, albinism includes decreased pigmentation of the skin, hair, and/or eyes. The current classification is based on the affected gene and is divided into OCA types 1 to 4 and Ocular Albinism type 1 (X-linked). There is little information in the literature on albinoidism. Some have reported that skin, hair and eye pigmentation are less than normal, but not as deficient as in patients with OCA. Ocular findings include no foveal hypoplasia, nystagmus, decreased visual acuity or photophobia but iris transillumination defects and fundus hypopigmentation.



# Protein and lipid cleaning of blue light-filtering contact lens with cleaning and lubricant drops

**First Author:** Cristina Bonnin-Arias<sup>1</sup>

**Co-Authors:** Eva Chamorro<sup>1</sup>, Ruben Urbano-Rodríguez<sup>2</sup>, Celia Sánchez-Ramos<sup>1</sup>

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<sup>2</sup> Avizor Laboratories, Spain

## **Purpose:**

To determine the efficacy of moisturizing Cleaning Drops® (Avizor) in eliminating protein and lipid deposits over contact lenses with and without blue light filtering.

## **Methods:**

Protein and lipid deposits were evaluated in non-blue light-filtering contact lens (Iotrafalcon B 33%WC) and blue light-filtering contact lens (Profilcon A 52%WC) after a cleaning process with moisturizing Cleaning Drops®. The control group consisted of untreated lenses. Analysis of lipid deposits was carried out by incubation of the contact lenses in a 1.5 ml solution composed of 0.17 mg/ml of free cholesterol and 0.23 mg/ml of cholesterol oleate for 96 hours. Cholesterol was extracted using a standard protocol and then, analyzed using High Performance Liquid Chromatography (HPLC) using a reverse phase C-18 Zorabax column (4.6×250 mm) (Phenomenex, Torrance, CA). The UV detector was set at 206 nm. Analysis of protein deposits was carried out by incubation of the contact lenses in a 1.5 ml solution composed of 0.5 mg/ml of albumin and 7.5µl/ml of <sup>14</sup>C-albumin for 96 hours. At the end of the specified incubation period, radioactive counts were determined in the lenses using liquid scintillation technique.

## **Results/Data:**

For the blue light-filtering contact lens, in the control group study, an amount of 24.70±9.6µm/lens of free cholesterol, 19.94±8.82µm/lens of esterified cholesterol, 44.65±12.14µm/lens of total cholesterol and 2.96±0.23µm/lens of albumin was observed. Once the cleaning by moisturizing Cleaning Drops® was done, an amount of 8.96±0.62µm/lens of free cholesterol, 3.78±1.19µm/lens of esterified cholesterol, 12.74±2.83µm of total cholesterol and 1.17±0.23µm/lens of albumin was observed. For non-blue light-filtering contact lens in the control group study, an amount of 17.47±2.35µm/lens of free cholesterol, 7.50±1.51µm/lens of esterified cholesterol, 24.97±3.61µm/lens of total cholesterol and 1.73±0.54µm/lens of albumin was detected. Once the cleaning by moisturizing Cleaning Drops® was done, an amount of 3.02±0.06µm/lens of free cholesterol, 10.13±0.58µm/lens of esterified cholesterol, 13.15±0.55µm/lens of total cholesterol and 0.13±0.06µm/lens of albumin. Using the cleaning and maintenance system Cleaning Drops® showed an efficacy for eliminating lipid deposits of 71% for blue light-filtering contact lens and 47% for non-blue light-filtering contact lens. The efficacy for eliminating protein deposits was 60% for blue light-filtering contact lens and 93% for non blue light-filtering contact lens.

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**Protein and lipid cleaning of blue light-filtering contact lens with cleaning and lubricant drops**

**Conclusions:**

Moisturizing Cleaning Drops® are effective to eliminate lipid and protein deposits on with and without blue light-filtering contact lenses tested.

**Acknowledgements:**

This study is part of a research project entitled "Contact lenses for blindness prevention, maintenance and hygiene products. Feasibility Study" subsidize by Comunidad de Madrid and FEDER funds granted to "Avizor" company.

# Distribution of macular parameters and their correlation with age in emmetropic spanish children

**Lead Author:** Inmaculada Bueno Gimeno<sup>1</sup>

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## **Purpose:**

To determine the distribution of macular thickness and its variation with age in Caucasian Spanish emmetropic children.

## **Methods:**

This cross-sectional study included fifty-one right eyes of 51 children, ranging in age from six to 10 years. Central subfield thickness, total volume and overall average thickness for the inner limiting membrane (ILM) - retinal pigment epithelium (RPE) tissue layer over the entire 6 x 6 mm square scanned area were measured by Spectral Domain Optical Coherence Tomography (Cirrus™ HD-OCT). Associations between measured parameters were evaluated by using Pearson correlation analysis.

## **Results:**

Central subfield thickness, total volume and overall average thickness were normally distributed. The average age ( $\pm$ SD) of emmetropic children was  $8.95 \pm 1.30$ . The mean ( $\pm$ SD) central subfield thickness of the fovea was  $255.22 \pm 18.26 \mu\text{m}$ . Mean total volume was  $10.15 \pm 0.54 \text{ mm}^3$  and mean ( $\pm$ SD) overall average thickness was  $282.71 \pm 13.39 \mu\text{m}$ .

We did not find significant correlations between macular parameters measured by Cirrus™ HD-OCT (central subfield thickness, total volume and overall average thickness) and age (Figure 1).

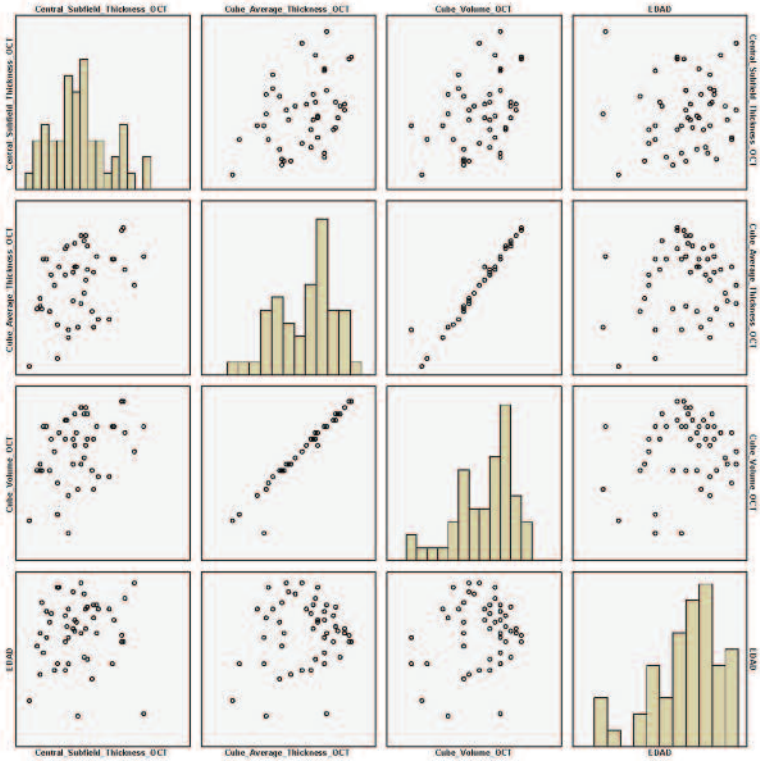
## **Conclusions:**

This study describes the distribution of macular parameters in emmetropic children. We did not find age related changes of the macular thickness in this narrow age group. Our results showed similar values of these parameters to that found in adolescence and adults studies, so, it suggests that the growth of these parameters is almost complete at or soon after birth. Age-related changes will be better shown in large longitudinal studies.

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**Distribution of macular parameters and their correlation with age in emmetropic spanish children**

**Figure 1:** Correlations between macular parameters and age.



# Relationship between corneal biomechanical parameters, retinal nerve fibre layer thickness and optic disc morphology in Spanish emmetropic children

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## **Aims / Purpose:**

To evaluate the possible associations between corneal biomechanical parameters as measured by the Reichert Ocular Response Analyser (ORA), optic disc morphology and retinal nerve fiber layer thickness (RNFL) measured by using spectral domain optical coherence tomography (Cirrus<sup>TM</sup> HD-OCT) in Caucasian Spanish emmetropic children.

## **Methods:**

This cross-sectional study included a hundred and one right eyes of 101 emmetropic children (48 boys and 53 girls), ranging in age from six to 17 years. Corneal hysteresis (CH), corneal resistance factor (CRF) corneal compensated intraocular pressure (IOPcc) and Goldmann correlated intraocular pressure (IOPg), were recorded with the ORA. Optic disc morphology and RNFL thickness were assessed by the Cirrus HD-OCT, whereas central corneal thickness (CCT) was measured by Anterior-Segment Optical Coherence tomography (Visante<sup>TM</sup> OCT). Associations between measured parameters were evaluated by using Pearson correlation analysis.

## **Results:**

The mean age ( $\pm$ SD) was  $11.28 \pm 2.98$  years. The mean ( $\pm$ SD) CH, CRF, CCT and RNFL thickness were  $12.57 \pm 1.68$  mmHg,  $12.64 \pm 1.91$  mmHg,  $541.94 \pm 35.09$   $\mu$ m, and  $100.39 \pm 11.32$   $\mu$ m respectively. An inverse weak correlation was found between average RNFL thickness and axial length ( $r = -0.21$ ,  $p < 0.05$ ). There were no significant correlations between corneal hysteresis, corneal resistance factor or CCT and the Cirrus<sup>TM</sup> HD-OCT parameters, whilst a weak correlation was found between corneal resistance factor and disc area ( $r = 0.20$ ,  $p < 0.05$ ). Average RNFL thickness was inversely correlated with both IOPg and IOPcc ( $r = -0.24$ ,  $p < 0.05$  and  $r = -0.24$ ,  $p < 0.05$  respectively).

## **Conclusion:**

Corneal biomechanical properties as measured with the ORA did not vary with optic disc parameters or RNFL in Caucasian Spanish emmetropic children. Average RNFL thickness decreases with longer eyes and increasing IOPcc and IOPg.

## Test bench for the assessment of multifocal intraocular lenses

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### **Purpose:**

To design and test an optical setup for evaluation of the optical properties of multifocal intraocular lenses (MIOLs) according to the International Standard Norm ISO 11979-9.

### **Methods:**

We built a test bench in order to determine the through-focus modulation transfer function (MTF) of refractive and diffractive MIOLs. The main parts of the setup are: source (LED  $\lambda=550$  nm), objects: a grid test and the USAF (US Air Force Target), collimating lens (focal length 160 mm) and CCD camera connected to a 5X microscope to capture the image formed by the model eye with the MIOL under test. A step motor moves the image plane along the optical axis. According to UNE IN-ISO 11979-9, the MIOL is placed in a wet cell with saline solution and the model eye includes a cornea lens and pupils of different diameters. For every lens under test, the whole procedure is controlled and processed by a dedicated software package.

### **Results:**

The optical performance of different commercial diffractive and refractive MIOLs have been tested and compared using the setup described above. The through-focus MTF was measured using two pupil diameters. For far distance and small pupil (2.7 mm), refractive MIOLs provided better MTF than the diffractive ones. For larger pupils (4.2 mm), the distance vision was similar with two MIOL models. However, diffractive MIOLs gave better image quality than the refractive ones for near vision with any pupil sizes. The images obtained for the USAF target are used as complimentary information of the MTF results.

### **Conclusion:**

We have designed and tested an optical bench for characterisation of MIOL following the requirements of the ISO 11979-9 Norm. The results obtained experimentally are in good agreement with the MIOLs previous reports. Our setup can be easily modified to MIOLs under polychromatic illumination.

# Blue light-filtering contact lens parameter changes after multi-purpose solution cleaning

**Lead Author:** Eva Chamorro<sup>1</sup>

**Co-Authors:** Cristina Bonnin-Arias<sup>1</sup>, Santiago Ríos-Santos<sup>2</sup>, Celia Sánchez-Ramos<sup>1</sup>

<sup>1</sup> Neurocomputing and Neurorobotics Group collaborator,  
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## Purpose:

The aim of the present study was to evaluate the physics compatibility properties of All Clean® multipurpose disinfection solution to blue light-filtering contact lens, based on the International Organization for Standardization (ISO) 18369-3:2006 guidelines.

## Methods:

A self-controlled trial was carried out in series of 10 disposable non blue light-filtering contact lenses (Hema 55%WC) and in series of 10 disposable blue light-filtering contact lens (Profilcon A 52%WC) to evaluate parameter changes after cleaning with All Clean Multi-purpose Solution Cleaning. Each contact lens was cleaned for 30 times. After the thorough cleaning process, total diameter (D), power refraction (P), UVB transmittance (TUVB), UVA transmittance (TUVA) and visible transmittance (TVIS) were measured. The parameters were statistically analyzed to evaluate the changes.

## Results/Data:

There were significant changes in the D, TUVA and TVIS of non blue light-filtering contact lens and changes in P of blue light-filtering contact lens. After the cleaning process with the All Clean® solution, physical properties of contact lenses Hema 55%WC changed as following:  $D=-0.02\pm 0.2\text{mm}$  ( $p=0.008$ ),  $P=0.09\pm 0.13\text{D}$  ( $p=0.07$ ),  $TUVB=1\pm 2\%$  ( $p=0.6$ ),  $TUVA=3\pm 2\%$  ( $p=0.0002$ ) y  $TVIS=1\pm 1\%$  ( $p=0.02$ ). Contact lenses Profilcon A 52%WC suffered the next variations in their physical properties:  $D=-0\pm 0.2\text{mm}$  ( $p=0.1$ ),  $P=0.23\pm 0.25\text{D}$  ( $p=0.01$ ),  $TUVB=1\pm 2\%$  ( $p=0.7$ ),  $TUVA=1\pm 2\%$  ( $p=0.9$ ) y  $TVIS=0\pm 4\%$  ( $p=0.3$ ).

## Conclusions:

Once the cleaning process with All Clean® solution is done, a statistically significant variation related to physical parameters was observed for both materials in the contact lenses. However, these parameter changes were not clinically significant because the changes were still in the tolerance range set by ISO (International Organization of Standardization). All Clean® multipurpose contact lens solution cleaning proved to maintain lens physics compatibility properties within its acceptable range.

## Acknowledgements:

This study is part of a research project entitled "Contact lenses for blindness prevention, maintenance and hygiene products. Feasibility Study" subsidized by Comunidad de Madrid and FEDER funds granted to "Avizor" company.

## The prevalence of visual impairment and blindness among the Roma population in Ukraine

**Lead Author:** Agnieszka Charaziak-Kovács

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### **Purpose:**

The purpose of this study is to determine the prevalence of visual impairment among an isolated, low-income, Roma population in Domboki village in Ukraine. According to World Romani Union and the Council of Europe there are nearly 400,000 Roma people living in Ukraine, many of them without electricity, primary education or health care.

### **Methods:**

A combined retrospective review of patient records previously obtained through census of 6-84 year old residents (85% response; n=102, 52% male) through the "Spectacles for the Roma" Refractive Program carried out between January and June 2011, and matched quality of life/literacy/socio-economic status questionnaire were used to elicit data for analysis. Visual acuity (Snellen, grouped according to IAPB/WHO categories of visual impairment and blindness), refractive error (RE) status (autorefractometer Retinomax Canon and Donders method), intraocular pressure (tonometer Diaton JGD- 02), anterior and posterior segment health, blood pressure, self-reported socio-economic status, literacy, education level and family structure were noted and analyzed (SPSS statistical package). Ethical considerations for the patients/subjects were followed according to the Declaration of Helsinki.

### **Results:**

Average family is 7 members, living on 27 USD/month. Average school attendance is 2.7 years and overall literacy 14%. Most (72%) have never had an eye exam and 92% present with visual acuity in WHO Category 1 (VA>0.3). Upon refraction, 62% out of all eyes were emmetropic. 25.5% were hypermetropic (most common among male children, <17 years old), and 12.7% myopic (myopia increasing with age, education level and literacy). Among school age children, 6-17 years old, prevalence of uncorrected myopia was 2% (p<0.05). With best correction, prevalence of visual impairment (VA <0.3 to 0.05) in the population was 3.9% and blindness (VA<0.05) was 1%. While the main cause of blindness (VA<0.05) in the population was cataract, 75% of those with low-vision (VA <0.3) were children with amblyopia secondary to uncorrected RE.

### **Conclusions:**

Recognizing the limitations associated with the methodology, it appears that the prevalence of visual impairment and blindness in the studied Roma population is higher, and it may be further exacerbated by the socio-economic and psycho-social factors. Population-based studies should be encouraged, especially given the impact of uncorrected refractive error on children, their scholastic achievement and well-being.



# Successful lid crutches fitting in patient with bilateral ptosis

**Presenter:** Roger Sin-fai Chiu

**Lead Author:** Kwai-mei Law

**Co-Author:** Roger Sin-fai Chiu

School of Optometry, The Hong Kong Polytechnic University,  
The Hong Kong Special Administrative Region, China

## **Purpose:**

To describe a successful case of lid crutches fitting in a patient with bilateral ptosis secondary to chronic progressive external ophthalmoplegia.

## **Method:**

A 80-year-old man was referred to the clinic for lid crutches fitting in 2006. He had a history of right macular scar with a long standing bilateral ptosis secondary to chronic progressive external ophthalmoplegia (CPEO). After 5 years, he returned to our clinic and complained about blurry vision in his left eye and would like to have the second pair of lid crutches after his cataract surgery in his left eye.

## **Results:**

Visual acuities were 10/125 and 20/20 for his right and left eyes respectively after refraction. Hirschberg test found right exotropia and hypertropia. Very limited ocular movement was found in motility test. Bilateral ptosis was found while the ptosis in his left eye was over the pupil.

A plastic frame was a better choice for making the lid crutches with a silicon type of nose pads in order to have less slipping. Also, a deeper frame size was chosen in order to provide a larger field of view for the patient. The lid crutches were screw on the rear side of plastic rims which should be thick enough to hold the lids. Spring hinge temples were used for easy handling of the spectacles by the patient. Lastly, the shape of the crutches was cut, soldered, modified and polished precisely according to the patient's lid. With the lid crutches, his pupils were no longer covered by his eyelids.

## **Conclusions:**

CPEO is a mitochondria disease and ptosis is frequently the first symptom with the limitation of ocular movement. Ptosis can not only cause cosmetic problems but could also impair vision and affect daily life. In spite of corneal exposure, ptosis surgery and lid crutches could be a solution. This case demonstrates a successful example of lid crutches fitting. It is crucial to have a careful frame selection, precise measurement of the lid position and the material use of lid crutches in order to have a successful fitting. In addition, patient education on the use of lid crutches is essential so that the patient can utilise it properly and benefit from it in their daily life activities.

## Variation in visual acuity measurement at different viewing distances: a comparison of results with two different chart designs

**Lead Author:** Robert Conway

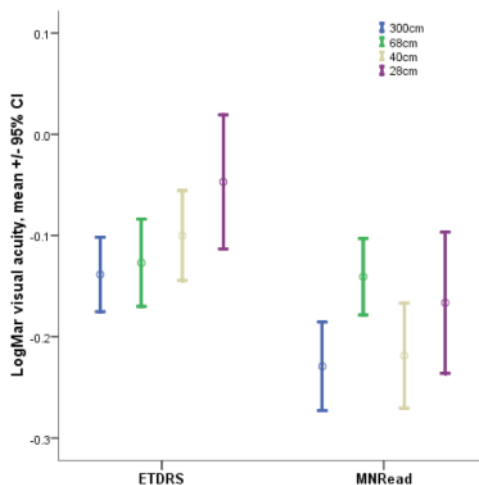
Department of Vision & Hearing Sciences Anglia Ruskin University, Cambridge, UK

### Purpose:

Visual acuity is assessed at both far and near distances when investigating refractive error or quantifying visual impairment. Far vision is typically assessed using letter based charts and near vision with function reading tests in literate patients. Data does not currently exist for letter and reading charts when used at varying distances. The purpose of this study was to investigate the variation in visual acuity measurement at different distances using the same chart design, and to compare the visual acuity results achieved with two different chart designs. The aim is to establish normative values for letter and functional reading chart formats.

### Methods:

The study employed a letter based chart (ETDRS, Prevision Vision USA) and a functional reading chart (MNRead, Lighthouse, USA) consisting of short passages of words and varying sizes. Visual acuity was measured for 30 participants with each of the two chart types at a far viewing distance of 3m and at an intermediate, standard near and closer near distance (68cm, 40cm and 28cm) chosen to reflect a range of functional test distances. Best corrected visual acuity scores were recorded for each chart for each viewing distance in logMAR format, scored to the nearest letter (ETDRS) or word (MNRead). Corrections to the logMAR chart score were made to account for viewing distance with an addition of 0.15 logMAR at 68cm and a subtraction of 0.23 logMAR at 28cm. The order of testing was randomised for both chart types and all testing distances.



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**Variation in visual acuity measurement at different viewing distances:  
a comparison of results with two different chart designs**

**Results:**

There was a good correlation between ETDRS and MNRead acuity scores for 3m and 40cm although MNRead acuities were significantly better ( $p \leq 0.05$ , figure 1). Repeated measures ANOVA showed a significant effect of viewing distance for each chart ( $F = 8.964$ ;  $p < 0.001$ ) with the greatest difference between far and closer near distance for ETDRS and between far and intermediate distance for MNRead.

**Conclusions:**

Visual acuities assessed with letter based and reading charts will not be comparable at equivalent distances and when used interchangeably at different viewing distances will over or under-estimate acuities. The better acuities found with the MNRead chart likely arise from the logMAR scores being derived from a limb width being taken as a fifth of lower case x height and the benefits of word shape recognition. Recalibration of word sizes to give equivalent scores to ETDRS letter acuities would allow the two chart formats to be used interchangeably in clinical settings.

## An evaluation of the City University Test (3rd Edition)

**Lead Author:** Peter Davison<sup>1</sup>

**Co-authors:** Ciara Creamer<sup>2</sup>, Ruth Dervan<sup>2</sup>, Maria Donlon<sup>3</sup>

<sup>1</sup> Department of Optometry, Dublin Institute of Technology, Ireland

<sup>2</sup> Practising optometrist, Kent, UK

<sup>3</sup> Practising optometrist, Dublin, Ireland

### **Purposes:**

No evaluation appears to have been published in the literature of the latest (third) edition of this test (CUT3, 1998), which was designed to improve on the sensitivity of the previous edition (CUT2, 1980). The primary objectives of the study were to compare the sensitivity and specificity of the test to the CUT2, to the D15 (on which the CUT2 is based) and to the Ishihara (24 plate) tests.

### **Methods:**

19 adult male subjects with suspected colour vision defects were tested using all 4 screening tests, the results of which were referenced to the Rayleigh match on the HMC anomaloscope. 20 adult subjects with presumed normal colour vision were also tested to enable specificity values to be derived. The data was also used to examine [1] the diagnostic accuracy of each test, and [2] the efficacy of each plate of the TCU3. All three screening tests were administered under colour-corrected illumination rated at 6,400 0 K.

### **Results:**

Nineteen colour defectives were examined, of whom 16 were classified as deuterans and three as protans by the HMC anomaloscope.

1. Sensitivity values ranged from 68% (CUT2 and D15) to 89% (Ishihara), with 84% for CUT3.
2. Specificity for all four tests was 100%.
3. Protan/deutan mis-diagnosis was highest for the Ishihara (18%), lowest for CUT2 and D15 (8%), with 13% for the CUT3.
4. The Ishihara test failed to detect any of the three protans, the CUT2 and D15 detected one protan, while the CUT3 detected two protans.

### **Conclusions:**

Introduction of new screening plates in the CUT3 has increased the sensitivity of the test relative to its predecessor. Although the sample of protans in this study was very limited, the re-organization of the diagnostic plates appears to have possibly reduced the diagnostic accuracy of the CUT3 compared to the CUT2, but both editions and the D15 appear to be superior to the Ishihara regarding ability to detect and classify protan defects.

# Fitting telescopes for bioptic Driving

**Lead Author:** Hendrick Peter Derksen

Holsboer Optometry 1867, Arnhem, the Netherlands

## **Background:**

In many states of the USA, people with moderately reduced visual acuity (e.g., 20/50 – 20/200) can legally drive with the aid of a small, spectacle-mounted (“Bioptic”) telescope. This presentation covers a demonstration project to assess the viability of implementing bioptic driving in The Netherlands. It describes the framework of the project from conception through to realisation of the primary objective – the introduction of bioptic driving as a legal option for visually impaired people in The Netherlands.

## **Methods:**

The project was based on bioptic driving programmes in the U.S.A., which were adapted to fit within current driving training and assessment practices in The Netherlands. The project convened a consortium of organisations including the Netherlands Bureau of Driving Skills Certificates (CBR), service organisations for the visually impaired, and research departments at universities investigating driving and vision. All organisations were educated about bioptic driving and participating professionals were trained in their specific aspects of the project. Media publicity led to significant interest and helped recruitment that enabled the screening and selection of potential participants.

## **Outcomes:**

The project demonstrated that people with moderately reduced visual acuity can be trained to achieve an adequate level of proficient and safe driving (as assessed by the local official driving licensing professionals) when using a bioptic telescope for the road conditions in the Netherlands. Based on the successful project outcomes, a request was made to the Minister to allow bioptic driving in the Netherlands.

This request was accepted by the government on 29 April 2009 during the ITMA conference at the Hague. From then on driving with a bioptic telescope became a legal procedure while driving a car.

## Impact of visual impairment on quality of life among older adults living in residential care

**Lead Author:** Mahesh Kumar Dev

Optometrist, Nepal

### **Background:**

Residential care residents have varieties of physical and psychosocial problems and among them eye problems are acute in terms of mobility especially when they are physically weak and psychosocially depend on others for support. Visual impairment has significant impact on quality of life of older residents. The purpose of this study was to explore the relationship between severity of visual impairment and quality of life (QoL).

### **Methods:**

A cross-sectional study was conducted on 128 residents of 60 years or older residing in seven residential cares of Kathmandu valley, Nepal. Presenting and the best corrected distance visual acuity were assessed in each eye with Snellen chart and the best corrected distance visual acuity was considered in the better eye. Near acuity was assessed binocularly with lighthouse near acuity card. Complete anterior and posterior segment examination was carried out. Interview was conducted using a face-to-face questionnaire of Nursing Home Vision-Targeted Health-Related Quality of Life (NHVQoL) among them.

### **Results:**

The mean age of residents was  $75.66 \pm 7.05$  years. The majority was female residents (65.6 %). The mean composite score of NHVQoL was  $52.22 \pm 12.49$ . There was a consistent overall deterioration in the mean composite score as well as subscales score of NHVQoL with worsening of visual acuity, gradually from normal residents with no visual impairment to moderate, severely and legally total visual impairment and accordingly QoL decreased gradually with increase in the severity of visual impairment. The decrease in vision related QoL score showed negative correlation with the severity of VI (Pearson's  $R = -0.579$ ) and was statistically significant ( $P < 0.05$ ).

### **Conclusion:**

The reduction in the QoL was associated with severity of visual impairment. The study recommends need to provide eye care services and social support by the government and the concerned group.

# Slab-off versus prism ballast back toric surface soft lenses: vision and comfort

**Presenter:** Philip Fine

**Lead Author:** Liat Gantz

**Co-Authors:** Ariela Gordon-Shaag, Liora Shenkman, Cyril Kahloun and Philip Fine

Department of Optometry and Vision Science, Hadassah Academic College, Jerusalem, Israel

## **Purpose:**

Patient preference, patient comfort and vision-related quality of life outcome were compared in prism ballast (PB) vs. slab-off (SO) stabilization techniques of optically identical toric soft contact lens in a semi-masked cross-over design.

## **Methods:**

T-lite toric soft contact lenses with a PB design were compared to a novel SO lens, both modes manufactured by Soflex and made of hydrogel (GM3) material with a back toric surface. Twenty four subjects (age range: 22-39,  $27.42 \pm 4.75$ , best spherical refractive error range: +5.00 to -6.00 D ( $-1.61 \pm 3.27$  D and  $-1.57 \pm 3.35$  D, for RE and LE, respectively), corneal astigmatism correction range: 0.75 to -2.75 D, ( $-1.49 \pm 0.60$  and  $-1.63 \pm 0.82$  for RE and LE, respectively)) were fit using the T-lite contact lens trial set. Subjects wore T-lite contact lenses for two weeks, followed by SO contact lenses for another two weeks, after a two day washout period. Subjects were masked to the identity of the lenses. Follow-up visits, scheduled one and two weeks after the initiation of each type of contact lens wear consisted of a visual acuity examination, measurement of contact lens stabilization time, contact lens movement with blinking, and the contact lens' influence on corneal integrity. The two-week visit also included a questionnaire on subjective visual function and comfort. The final visit included a questionnaire comparing the two lenses.

## **Results:**

There was no significant difference in visual acuity between the two lens designs. However, the SO lenses received significantly higher scores in almost all categories of patient comfort and vision-related quality of life outcome. The subjects found it to be generally more comfortable ( $p < 0.01$ ), more comfortable throughout the day ( $p < 0.0001$ ) and easier to insert ( $p < 0.02$ ). They found the SO provided more stable vision while working at a computer ( $p < 0.01$ ) and while driving at night ( $p < 0.0001$ ).

When asked to compare both lenses, 80% of the subjects reported that the SO lenses were more comfortable, 64% reported that they could wear them longer, 55% found that the SO lenses provided better vision after several hours of wear, and 64% found that they were better in dim lighting conditions. When asked which lens they wanted to continue to wear, 82% preferred the SO, 5% preferred the PB, and 14% had no preference.

## **Conclusions:**

The SO contact lens design was found to be more comfortable and perceived to provide more stable vision than the PB contact lens design.

## Visual acuity testing in a low vision practice using the PGRS chart with reversed sequence

**Lead Author:** Paul G.J. Gerringa

Low Vision Europe

### **Purpose:**

To investigate the benefits of an optotype chart with a reversed sequence, starting with small instead of big optotypes. This investigation looked at whether there is a significant difference in threshold visual acuity using the PGRC LV chart, if this is a time saving routine and if there are significant differences in subjects while using the PGRS LV chart in sex, age or the background of the reduced visual acuity.

### **Methods:**

The project started with a normal Snellen chart to define the best Rx. The optotype chart was placed at two meters distance. Room illumination was 200 lux and the luminance of the chart was 400 lux. The subject had to define four or five of five SLOAN letters correctly. Four charts were used: the Colenbrander LV chart, CB with reversed sequence, PGRS LV chart and PGRS with standard sequence. So two charts for each eye were used. Half of the subjects started with the normal sequence and half with the reversed sequence. VA and required time needed to approach threshold VA were measured.

### **Results:**

I tested > 100 subjects with Visual Acuity between 0.02 (20/1000, LogMAR +1,7) and 0.63 (20/32, LogMAR +0.3) (mean value 0.25, 20/80, LogMAR +0.6).

The result shows no significant differences in subjects while using the PGRS LV chart in sex, age or the background of reduced visual acuity. There was one to 55 seconds less time necessary for the VA assessment. The mean time gain was 35%. It was also found that for almost half of the subjects with Visual Acuity between 0.02 (20/1000, LogMAR +1.7) and 0.4 (20/50, LogMAR +0.4) the VA measured on the reverse chart increased by 1 line. The other half of the subjects recorded the same VA with Normal LV chart or PGRS LV chart.

### **Conclusions:**

The use of reversed sequence optotype charts is a time saving routine and the subject will read smaller optotypes because he is less tired and more concentrated. This routine is less invasive for our clients. Thus, testing VA using the PGRS Chart has some benefits for our LV clients, and it is useful for testing VA in the Low Vision practice.

### **Disclosure:**

Low Vision Europe has a financial interest in the PGRS LV chart (patent pending).



# Contrast sensitivity in one-eyed patients

**Lead Author:** Trisevgeni Giannakopoulou

**Co-Authors:** Sotiris Plainis, Miltiadis K Tsilimbaris, Ioannis G Pallikaris

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## **Background:**

It is widely accepted that monocular deprivation causes an improved visual performance in the non-pathological eye. The aim of the study was to investigate the effect of monocular deprivation on the contrast sensitivity performance of the fellow eye.

## **Methods:**

20 subjects with an average age of  $29 \pm 10$  years (range 15 to 45 years) and severe visual impairment in one eye (visual acuity equal or worse than FC at 1 m) were included in the study. 18 more subjects with an average age of  $28 \pm 5$  years (range: 23 to 41 years) served as the control group. Contrast sensitivity was evaluated using vertical sinusoidal gratings modulated at a frequency of 2 Hz in a square-wave reversal mode, displayed on a 21-inch CRT monitor (mean luminance was 30 cd/m<sup>2</sup>), seven spatial frequencies (1, 2, 4, 8, 12, 16 and 24 c/deg) were tested. In order to evaluate any bandwidth-specific loss, the area under the contrast sensitivity function (AUCSF) was calculated for three spatial frequency ranges: the full (0.0 to 1.2 log c/deg), the low (0. patients0 to 0.5 log c/deg) and the high (0.5 to 1.2 log c/deg) range. Performance of the control group was tested both monocularly (dominant eye) and binocularly.

## **Results:**

In all participants of the control group, contrast sensitivity was found higher with binocular compared to monocular vision at all spatial frequencies. The average binocular minus monocular difference in contrast sensitivity for all spatial frequencies was 4.2 dB, which corresponds to a 70% improvement in contrast threshold. Contrast sensitivity was found higher at all spatial frequencies in the monocularly-deprived patients compared to the dominant eye of the control group. The average difference in contrast sensitivity between the two groups was 5.0 dB, which corresponds to a 83% improvement in contrast threshold. High statistical significant differences between the two groups were found in full-, high- and low- AUCSF areas ( $p < 0.001$  for all conditions; independent samples t-tests). Finally, the average contrast sensitivity in one-eyed patients was higher (0.84dB) than the binocular values of the control group.

## **Conclusions:**

Monocularly-deprived subjects show higher contrast sensitivity compared to monocular values of normal age-matched subjects. The improved performance of the non-pathological eye of patients with monocular deprivation may be a result of the neuronal synaptic plasticity of the visual cortex.

# Dynamic contour tonometry (DCT) over daily disposable hydrogel and silicone-hydrogel contact lenses with different dioptric powers and material characteristics

**Lead Author:** Fabrice Gogniat

**Co-Authors:** Daniela Steinegger, Daniela S. Nosch, Roland Joos, Michael Goldschmidt

University of Applied Sciences, Institute of Optometry, Olten, Switzerland

## **Purpose:**

Dynamic Contour Tonometry (DCT) has been shown to measure the intraocular pressure (IOP) independently of corneal thickness. The aim of this study was to find out if DCT remains accurate when the IOP-measurement is taken over contact lenses (CL) of different thicknesses and different soft materials.

## **Methods:**

This was a prospective, randomized study which included 42 patients (21 right and 21 left eyes). The age varied from 22 to 59 years (mean:  $26.5 \pm 6.3$  years). Intraocular pressure (IOP) and ocular pulse amplitude (OPA) measurements were taken under topical anaesthesia without contact lenses (CL) and over various daily disposable CLs with the dioptric powers of  $-0.50$ ,  $+5.00$  and  $-5.00$  D, in hydrogel (Nelfilcon A) and in silicone-hydrogel (Narafilcon A) materials. The order of measurements was randomized and balanced.

## **Results:**

Regarding dioptric CL-powers, the mean differences in IOP measurements were not found to be statistically significant when comparing 'no CL' with  $+5.00$ D ( $p=0.103/0.24$ mmHg),  $-5.00$ D ( $p=0.317/0.15$ mmHg), and  $-0.50$ D ( $p=0.716/0.06$ mmHg) without taking into account CL material. Regarding the materials used, there was no statistically significant difference in IOP when comparing them with 'no CL', neither for the hydrogel, nor for the silicone hydrogel (SiHy) group ( $p=0.23/0.17$ mmHg and  $p=0.311/0.14$ mmHg, respectively) without considering individual CL powers. However, there was a significant difference when considering the hydrogel versus the SiHy group ( $p=0.004/0.29$ mmHg). Statistical significance could also be found when comparing  $+5.00$ D versus 'no CL' within the hydrogel group ( $p=0.000/0.65$  mmHg), but not when comparing the same within the SiHy group ( $p=0.311/0.16$ mmHg).

Regarding OPA measurements, no significant differences were found between measurements with and without CL: the mean difference in measurements for the hydrogel versus the SiHy group was  $0.07$ mmHg ( $p=0.610$ ), and the variable 'lens power' did not reach any statistical significance either ( $p=0.816$ , coefficient of  $0.00029$ ).

## **Conclusion:**

This study showed good reliability of IOP and OPA measurements over CLs with varying thickness profiles and different soft materials when using the DCT. Only a small but statistically significant difference of  $0.65$ mmHg was found for the IOP measurement with the hydrogel CL of  $+5.00$ D compared to 'no CL'.

# The importance of the ophthalmic progressive lens shape on the space perception

**Lead Author:** C Guilloux

**Co-Authors:** H de Rossi, G Marin, B Bourdoncle, M Hernandez, L Calixte, F Karioty

Essilor International, Vision Science, France

## **Introduction:**

Ophthalmic progressive lenses generate space deformation, that is to say distortion of the objects seen through the lens. This is roughly due to power progression in the lens. The most common effect is known as “swimming effect” sometimes reported by wearers in binocular and dynamic vision. It is commonly admitted that these effects are closely linked to the optical properties of the lenses (i.e. power and aberration repartition), thus establishing a necessary compromise with the fields of vision. The aim of this study was to find and validate experimentally different ways to design an ophthalmic progressive lens in order to minimize space deformation without compromising the fields of vision.

## **Methods:**

Space deformation has been modelled with ray tracing and characterized by optical criteria calculated on distorted grid. The study evaluated the effects on space deformation for a given power and aberrations distribution for various shapes of the lens. A new method of optimisation was used, allowing the modification of the geometry while maintaining the optical properties of the lens. An experimental study with a virtual lens simulator was also conducted. This tool allows the simulation of dynamic binocular space deformation seen through virtual lenses in real time when moving the head thanks to stereoscopic display and head tracker. 10 subjects compared their perception of a grid through different ophthalmic lenses having different shapes but with exactly the same power and aberrations distribution.

## **Results:**

It is possible to manage space deformation thanks to the shape of the lens without modifying the power and aberrations distribution. The experimental study shows that the subjects perceive differences in space deformation among the tested lenses. Lens designs could be generated with significant reduction of space deformation without changing the power and aberration distribution.

## **Conclusions:**

This study demonstrates the importance of the geometrical shape of ophthalmic progressive lenses for space perception. Moreover it defined a new way to optimise these lenses. This study leads to the design of new types of progressive lenses having advanced shapes minimising space deformation without compromising the field of vision.

## Baby vision

**Lead Author:** Caroline Guy

Department of Contactology in Olten, Switzerland

### **Background:**

Visual impairment, regardless of its nature or extent is likely to affect the healthy development of children and lower their academic performance. Severe visual impairments in young children, although rare, are easily identified. However, mild impairments are very common and may go unnoticed. In order to reduce the consequences of such handicaps, it is necessary to do an early visual screening in order to quickly direct the child to specialised care. Naturally, the sooner eye treatment can be initiated, the more likely the child will cooperate and the end results will be better with a maximum effectiveness starting before the age of three.

Educational testing services provide useful initial visual screening for a child but these start only at the age of five. Therefore the current situation on visual screening for children between birth and three years of age was reviewed because it is of interest to long-term public health.

### **Methods:**

Paediatricians and general practitioners, who examine children regularly from birth, participated in this study. The survey was conducted using a questionnaire and only involved the French speaking cantons (Fribourg, Geneva, Jura, Bern (Jura), Neuchâtel, Valais and Vaud) due to language issues.

185 (N=1,230) medical professionals were involved in the investigation, which gave a participation rate of 15%.

### **Results:**

The visual screening of children from birth to three years old done by paediatricians and general practitioners was on the whole comprehensive. Indeed, disorders and visual impairments were usually well examined with the exception of glaucoma, which was rarely looked for by the majority. Moreover, the majority of the practitioners were doing all the required visual tests. The tracking reflex was the most consistently carried out test and the occlusion reflex the least.

### **Conclusions:**

According to the doctors' feedback, one area of potential improvement involved the role parents' play (or do not play) in the early visual screening process. However, parents are usually not aware of the various impairments and childhood eye disorders, even though they are best placed to carefully observe their daily behaviour. Their role is seen as essential. To overcome this, a website aimed at informing parents about the normal development of children's vision was created, including the risk factors and the different warning signs ([www.babyvision.ch](http://www.babyvision.ch)).

# Changing of intraocular pressure caused by a one-shot physical activity

**Lead Author:** Eliška Hladíková

**Co-Authors:** Lucie Glogarová, František Pluháček, Jiří Bajer

Department of Optics, Faculty of Science, Palacký University Olomouc, Czech Republic

## **Purpose:**

The main aim of the study was to determine if the intraocular pressure is significantly influenced by a one-shot physical activity. The correlation between the changes in the intraocular pressure and the blood pressure and pulse were monitored.

## **Method:**

Forty six participants were included in the study (11 men, 35 women), their age ranging from 18 to 30. The intraocular pressure (IOP), blood pressure (BP) and pulse were measured before and after the physical activity of each participant. The intraocular pressure (IOP) was measured by a non-contact tonometer. The systole and diastole blood pressure (SBP, DBP) and pulse were measured by a digital automatic blood pressure monitor. The first measurement was done after several minutes of quiescent regime of each participant. Next, the physical activity was realised using an indoor exercise bike with a fixed load for ten minutes. All parameters were re-measured immediately after the activity. The changes of the studied parameters were statistically evaluated by the t-test for the significance level  $p$ . The relationships between the monitored quantities were analysed by the correlation analysis.

## **Results:**

The obtained results prove a significant decrease of the IOP immediately after the physical activity ( $p < 0.0001$ ). The correlation analysis showed a significant relationship between activity-induced changes of IOP and its resting values (correlation coefficient  $r = 0.6$ ,  $p < 0.0001$ ). Another statistically significant correlation was found between the changes of IOP and changes of SBP ( $r = 0.37$ ,  $p < 0.01$ ). Other relationships between IOP and blood pressure or pulse were insignificant.

## **Conclusion:**

The results of the presented research indicate that the one-shot physical activity reduces the IOP immediately after the activity. Moreover, the IOP change is dependent on its values before the activity. The higher the pressure before the activity, the more marked the decrease of IOP after the activity and smaller values of IOP tended to smaller or no changes of IOP. No correlations were proved between intraocular pressure and blood pressure or pulse, only an insignificant relationship between the change of IOP and the change of SBT was found.

## Measuring the rate of dark adaptation: repeatability and an age effect

**Lead Author:** Jeremiah MF Kelly

**Co-Authors:** Ian J Murray, David Garden

The University of Manchester, Manchester, UK

### Introduction:

Interest in rod-mediated vision is increasing, driven partly by the fact that rods are selectively impaired in age related macular disease. Furthermore, systemic diseases such as hepatitis, cirrhosis and malnutrition can affect rod-function. It has been shown that the rate of recovery of rod-mediated vision following a bright flash of light is a sensitive assay of retinal health (Owsley 2001). It is timely therefore that a new technique should be considered and evaluated.

### Method:

This study was granted ethical approval by the Ethics Research Committee for the Experimentation on Humans at The University of Manchester (reference 09169). The experiment was carried out in accordance with the tenets of the Helsinki Protocol.

We measured the recovery of rod sensitivity following a bright flash of light in 35 subjects 39.6( $\pm$ 19.2) years, 12 female. 27 subjects returned for a second measurement.

Thresholds were obtained using a green stimulus of 4degrees diameter (540nm) at 15degrees temporal eccentricity superimposed on a dim (0.05cd.m<sup>-2</sup> photopic) red background (670nm). The thresholds were collected for 20 minutes at 30 second intervals.

A seven parameter model of rod sensitivity recovery was fitted to the data. It comprised an exponential cone phase and two linear rod phases. A semi-log plot is illustrated in Figure 1. The parameters were determined by a nonlinear regression. The parameter of most interest is the rate of rod recovery (S2).

### Results:

Repeatability: the two estimates of the S2 component had a Pearson correlation coefficient of 0.70 ( $t = 4.85$ ,  $df = 25$ ,  $p$ -value  $<<0.001$ ), with a 95% CI of 0.43–0.85.

A paired t-test showed that the differences were not significant ( $t=0.587$ ,  $df=26$ ,  $p=0.562$ ). The coefficient of repeatability was 0.13. Regression analysis of the difference against the mean estimates failed to reach significance ( $F=0.92$ , 25  $df$ ,  $p= 0.35$ ).

**Effect of age:** Two groups of observers were tested, one less than 40 years and the other 40 years and above. The mean ( $\pm$ sd) rate of rod recovery for the younger group was  $-0.286 (\pm 0.084) \log_{10} (\text{cd.m}^{-2})/\text{min}$ , while for the older group it was  $-0.219 (\pm 0.116) \log_{10} (\text{cd.m}^{-2})/\text{min}$ . This difference just failed to reach formal statistical significance ( $t = -1.9895$ ,  $df = 33.97$ ,  $p$ -value = 0.0548).

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### Measuring the rate of dark adaptation: repeatability and an age effect

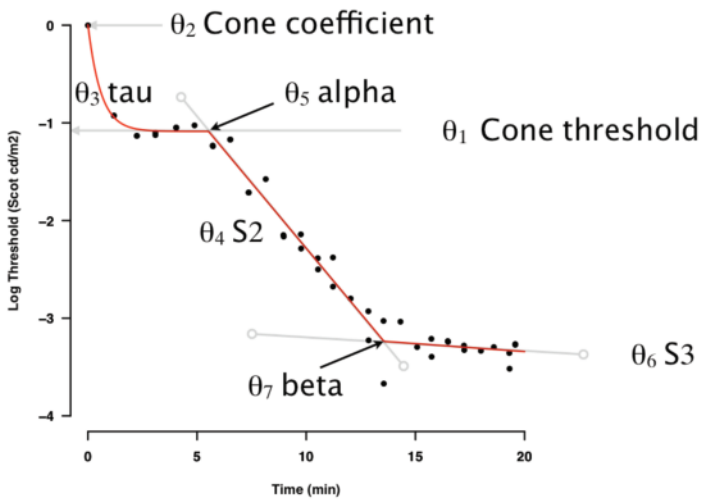
When age was plotted against S2 a function described by the equation  $S2 = -0.33 + 0.002 \cdot \text{Age}$  (F 4.79 on 1 and 34 DF, p-value: 0.03) was obtained. That is S2 rises by 0.02 log<sub>10</sub> (cd.m<sup>-2</sup>)/min a decade. This is in agreement with other work (Lamb 1981, Jackson 1999).

The mean value of S2 for the 35 subjects was found to be  $-0.248 (\pm 0.09)$  log<sub>10</sub> (cd.m<sup>-2</sup>)/min.

#### Conclusion:

The technique produces measurements of S2 that are repeatable and sufficiently sensitive to demonstrate changes in rod function with age in a small sample.

**Figure 1:** The parameters of the model fitted to the data



## Age and sex related changes on the corneal thickness and anterior corneal curvature in Korean young children with the orbscan II topography

**Lead Author:** Douk Hoon Kim

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### **Purpose:**

To study the influence of age and sex related changes on the corneal thickness and anterior corneal curvature in Korean young children with the Orbscan II topography.

### **Methods:**

The Orbscan II topography is a computer-assisted scanning technology that can map the anterior section of the cornea. It was used to take a test on 584 eyes of 292 normal Korean young children ranging in age between five and 26 years (146 male and 146 female). The central and paracentral corneal thickness at a distance of 3mm from the corneal centre were analysed. Using spss 14 and t-test, we investigate a statistical analysis of the parameters of age and sex.

### **Results:**

The mean central corneal thickness of all subjects was  $547.532 \pm 44.529\mu\text{m}$ . There was no statistical difference ( $p>0.5$ ) in mean central corneal thickness between men and women. Also sex and age related changes in mean central corneal thickness was not specific statistical difference ( $P>0.5$ ). The mean peripheral corneal thickness of all subjects was  $568.215 \pm 39.647\ \mu\text{m}$  nasal,  $575.157 \pm 39.420\ \mu\text{m}$  superior nasal,  $580.717 \pm 40.736\ \mu\text{m}$  superior,  $576.183 \pm 43.412\ \mu\text{m}$  superior temporal,  $568.826 \pm 46.289\ \mu\text{m}$  temporal,  $566.097 \pm 46.682\ \mu\text{m}$  inferior temporal,  $564.442 \pm 44.190\ \mu\text{m}$  inferior,  $565.099 \pm 40.751\ \mu\text{m}$  inferior nasal, respectively. There was no significantly statistical difference ( $p>0.5$ ) in mean peripheral corneal thickness in eight paracentral zone between men and women. Also sex and age related changes in each eight paracentral corneal thickness was not specific statistical difference ( $P>0.5$ ). However there was very significant statistical difference ( $p>0.000$ ) between mean central corneal thickness and eight paracentral corneal thickness in all subjects. The range of central cornea of the lowest region was  $403\mu\text{m}$  to  $628\mu\text{m}$  and superior region of highest mean thickness was from  $461\mu\text{m}$  to  $6664\mu\text{m}$  in all subjects.

Correlation between anterior corneal curvature and central corneal thickness in all subjects was negative status, except for the twenties years old.

### **Conclusions:**

The study found that the corneal thickness change in Korean young population have no relationship between age and sex. However the relationship between mean central corneal and eight paracentral corneal thickness was strong statistical differences in all subjects. Also age and sex related changes in central corneal thickness and anterior corneal curvature in all subjects was not merely statistically different, except from 20-26 years old age ( $p>0.05$ ). This information was a suitable reference basis for future studies in young population of Asian.



# Where should the bars be to produce optimal crowding effects using children's acuity letters, pictures and symbols?

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## **Purpose:**

Crowding is widely considered to be important for improving the detection of amblyopia. The effect of crowding at different separation distances has been investigated using Landolt C's, Sloan E's and letters (e.g. Flom et al. 1963; Jeon et al. 2010; Shah et al. 2010). However, it has not been systematically investigated using optotypes from children's acuity charts despite "crowded" versions of these charts being commonly used for vision screening of young children.

## **Methods:**

Four adult participants with corrected-to-normal vision (visual acuity of 6/5 or better) and normal binocular vision (stereoacuity of 30" arc or better) were tested with Kay Pictures, Lea Symbols and HOTV optotypes, both isolated and with a surrounding box abutting and 1, 2, 3, 4 and 5 stroke widths away. Visual acuity thresholds were obtained from psychometric functions, which were generated using a method of constant stimuli and 7 logMAR acuity sizes for each box separation, in a systematic and counterbalanced order.

## **Results:**

There was a significant difference between the resolution thresholds obtained with the three tests ( $p < 0.001$ ). The lowest thresholds (best visual acuities) were obtained with the Kay Pictures and the highest with the Lea Symbols. The magnitude of crowding (the difference in acuity measured with a surrounding box and with the isolated optotype) was not significantly different for the three test types ( $p > 0.1$ ). Peak crowding occurred either when the box was abutting, or placed 1 stroke width away, and amounted to about 1 line in logMAR acuity. The extent of crowding was similar for the three test types ( $p > 0.1$ ) at  $3.6 \pm 0.4$  stroke widths for Kay Pictures,  $3.7 \pm 0.9$  stroke widths for Lea Symbols and  $3.9 \pm 0.3$  stroke widths for the HOTV optotypes.

The magnitude and extent of crowding (in stroke widths) were similar for the three types of optotypes investigated in this study. The crowding features are placed approximately 0.5 optotypes away on the commercially available Crowded Kay Picture and Crowded Lea Symbols charts and on the modified HOTV charts (PEDIG, 2001). This separation is equivalent to 5, ~3.6 and 2.5 stroke widths for the Kay Pictures, Lea Symbols and HOTV charts respectively.

## **Conclusions:**

Our results suggest that in adults the Crowded Kay Picture chart may not produce crowding effects, the Crowded Lea Symbols chart may only produce minimal crowding effects but the modified HOTV chart would produce a crowding effect. The effects of crowding would be larger if the box was placed 1 stroke width away from the optotype.

## A review of Welsh Eyecare Initiative (WECI) registered optometrist referrals and GP notifications over a three week time period

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**Co-Author:** N Sheen

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### **Purpose:**

To review the information detailed on optometrist referrals to the hospital eye service (HES); referrals to the General Practitioner (GP) and notifications to the GP.

### **Methods:**

Optometrists in Wales registered to provide patient WECI services were asked to submit a copy of all referrals and GP notifications from patients seen within a three week time period in October 2011. To preserve anonymity, both patient and optometrist details were removed prior to the records being sent off. Ethical approval was confirmed as not being necessary as this was a service review. All information was inputted into an Access database by two users.

Outcomes determined were: if enough appropriate information was contained within the referrals/notifications (with reference to established guidelines where possible); if the action required and the timescale of the action required were recorded; the legibility of handwriting, if handwritten. Judgment of the appropriateness of the referral itself was not carried out.

### **Results:**

Out of 158 records analysed so far, 59 (37%) were handwritten; all of which were of acceptable quality. Of those patients with presenting symptoms the commonest was eye pain/discomfort (28.2% of all records) followed by flashes and floaters (16.0% of all records). Out of patients seen, 41 (26%) were referred to the HES, 14 (8.9%) referred to the GP and 103 (65%) were managed by the optometrist. Cataract, glaucoma and macula referrals accounted for 17.0%, 14.6% and 4.9% of referrals to the HES, respectively. Visions or visual acuity was not recorded as required in 22 (14.0%) of records.

Out of all records 143 (90.5%) had adequate recording of the action required and 135 (85.4%) had adequate recording of the action timescale.

Of note is that chloramphenicol was prescribed in nine (5.7%) cases with dry eye drops in 23 (15.6%) of cases.

### **Conclusions:**

WECI accredited optometrists continue to manage the majority of patients within optometry practices without onward referral. The figures compare well with previous evaluations of WECI services.

Communication in optometry referral and notifications could be improved with key items such as vision/VA omitted in a significant proportion of cases. The findings of this review will be used to inform peer review sessions. A further audit of referrals and notifications will take place after peer review sessions.

# Keratoconus in a Saudi Population: associated clinical findings

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**Co-Author:** Turki M. Almubrad

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## **Purpose:**

To assess the common complaints of keratoconic patients in Saudi Arabia.

## **Method:**

A two year prospective study on keratoconic patients who visited three different eye clinics in Riyadh. Data obtained and analyzed included: the age of onset of keratoconus, age at time of study, gender, keratometer values, stage of keratoconus, visual acuity, spectacle and contact lens correction, percentage of visual success, associated complaints such as eye rubbing, allergy, vernal keratoconjunctivitis (VKC), and eye redness.

## **Results:**

The mean age of the 237 keratoconic patients enrolled in this study was  $21.2 \pm 6.2$  years (range 8-48years). Percentage distribution of subjects originating from Assir, Riyadh, Nejran, Qassim, Mecca, Shargiyah, Tabuk and Jizan provinces respectively were; 64.7%, 21.9%, and 13.4% (shared between the remaining six provinces). At all stages of the disease, a female gender bias was evident (two, 71, 38, 10 eyes, mild, moderate, advanced and severe keratoconus respectively). The disease occurrence is high and sets in much earlier in life ( $14.8 \pm 3.9$ years,  $15.9 \pm 3.9$ years (mean  $\pm$  SD), male and female subjects respectively). Average cornea curvature was  $50.5 \pm 6.0$  Dioptres (range 37.3-76.8D) with a predominance of moderate keratoconus in both sexes followed by eyes in the advanced stage of keratoconus (51.2%), mild keratoconus (29%) and severe keratoconus (12%). Of the risk factors, 6.8% claimed having a positive family history (FH) of keratoconus, and an FH of high myopia (1.7%). 105 (44.3%) experienced at least one of the associated disturbances of eye rubbing, tearing, redness, allergy, asthma, & eczema. The mean manifest refractive spherical equivalent correction (MRSEC) was  $-2.96 \pm 0.19$ DS. On analysis, visual acuity (VA) of patients significantly improved ( $p < 0.0001$ ) by about seven lines in both eyes after correction with contact lenses or spectacle lenses.

## **Conclusion:**

The results demonstrate predominance of keratoconus in patients from Assir province, Saudi Arabia with early onset especially in females. Keratoconus sets in much earlier than previously reported in other populations and progresses rapidly at an early age. Most patients were bilaterally affected. At the different stages of the disease, contact lenses still remains the most popular method of treatment. The main presenting visual symptoms were in the order of red eyes, eye rubbing and tearing.

## A comparative study of dry eye diagnosis testing systems using the TearLab Osmolarity system and Schirmer's tear test

**Lead Author:** Ann-Marie Masterson

**Co-Author:** Arthur Cummings, Avril Barnes, Lisa McLoughlin, Isobel Brennan

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**Purpose:**

To determine the accuracy and efficiency of the TearLab Osmolarity system in comparison to Schirmer's testing for pre-operative assessment of dry eye syndrome.

**Methods:**

Retrospective study of more than 100 patients who were being assessed for their suitability for LASER vision correction (LVC). At pre-assessment for LVC, all patients underwent Schirmer's tear test and TearLab Osmolarity testing. Patients were assessed at their six week post-operative visit for evidence of dry eye.

**Results:**

Pre-operative tear osmolarity testing with TearLab more closely correlates to the presence/absence of dry eye symptoms post LVC.

**Conclusion:**

The findings suggest that tear osmolarity testing is a more accurate predictor of post LVC dry eye than Schirmer's. Pre-operative osmolarity levels appear to positively correlate with a patient's post-operative development of dry eye.

# The relation between higher order ocular aberrations and visual function in children with and without Down syndrome

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**Co-Authors:** Dr Julie-Anne Little, Dr Kathryn J. Saunders

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## **Purpose:**

Previous studies report atypical optical structures in Down syndrome (DS) and a degrading influence of the optics on visual performance. Recent work from our laboratory has shown greater levels of higher order ocular aberrations (HOA) and reduced optical quality in children with DS compared with age-matched typically developing children. The present study investigates the relation between measures of optical quality and visual function for children with and without DS.

## **Methods:**

Participants were 25 children with DS (six - 16 years) and 192 age-matched controls. HOA aberrations were measured following cycloplegia for the dominant eye using Shack-Hartmann aberrometry (IHX3, Imagine Eyes). Zernike coefficients were analysed over the central pupil area (3mm diameter) from third to sixth order and the root mean square (RMS) values of total coma, trefoil, spherical aberration and combined higher order aberrations were calculated. Strehl ratios were derived to describe optical quality. Three measures of visual function were assessed for the dominant eye; high and low contrast recognition acuity and grating resolution acuity. Convolutions of point spread functions (PSF) were also used to simulate image quality.

## **Results/Data:**

Weak relations were found between HOA data and all measures of visual function for both the DS and control groups. Statistically significant relations were found between the RMS of coma and low contrast recognition acuity ( $r=0.14$ ,  $p<0.05$ ) and grating resolution acuity ( $r=0.16$ ,  $p<0.05$ ) for the control group. A similar correlation was found between the RMS of coma and low contrast acuity for the DS group but did not reach statistical significance ( $r=0.23$ ,  $p=0.30$ ). Figure 1 shows PSF for participants with average optical qualities for the DS and control groups and the convolution of these to an image of a Maltese cross.

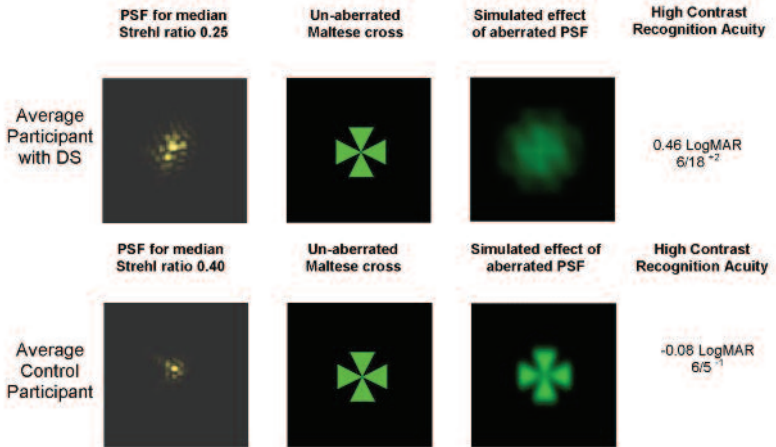
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**The relation between higher order ocular aberrations and visual function in children with and without Down syndrome**

**Conclusions:**

Non-rotationally symmetric coma aberrations were more deleterious to visual performance than rotationally symmetric aberrations for both groups. However, in agreement with previous adult studies, no further correlations were found between optical quality and visual performance amongst typically developing children and those with DS. Visual performance remains robust in the presence of HOA which may be explained by neural adaptation which compensates for retinal image blur. Poorer visual acuities in the DS group may suggest this process is compromised by the poor cortical development and atypical cortical organisation reported in DS.

**Figure 1**



# Corneal cross-linking (CXL) with second harmonic (SH) optical microscopy imaging and accelerated corneal cross-linking preliminary clinical results

**Lead Author:** R. McQuaid<sup>1,2</sup>

**Co-Authors:** JiaJun Li,<sup>2</sup> Arthur Cummings,<sup>1</sup> Michael Mrochen,<sup>3</sup> and B. Vohnsen<sup>2</sup>

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## **Introduction:**

Corneal collagen cross-linking slows down or fully stops the progression of keratoconus, avoiding the need for transplantation or grafting. A clinical study reducing treatment time from 30 minutes to 10 minutes has been introduced. Lab work conducted in University College Dublin investigated the difference between the standard cross-linking to accelerated cross-linking using second harmonic (SH) optical microscopy imaging.

## **Purpose of study:**

In the clinic, CXL may take up to one hour per eye causing significant stress to the patient being exposed to the UV light. Higher intensity CXL has proven to be as effective as the standard treatment but this might have a detrimental impact on the corneal collagen fibril ordering as a consequence of the more intense UV radiation.

## **Methods:**

Post-mortem porcine corneas removed with a trephine and standard Cross-Linked (CXL) with  $3\text{mW}/\text{cm}^2$  have been compared to accelerated cross-linked (AXL) corneas with  $10\text{mW}/\text{cm}^2$  using second-harmonic (SH) optical microscopy imaging.

Here, SH transmission images of fibrils in post-mortem porcine corneas under CXL and AXL conditions respectively will be compared. UV-XTM lamps (supplied by IROC, Switzerland) were used for cross-linking and the SH images were recorded using an ultrafast (50 fs) Ti-Sapphire laser. To prevent cornea clouding porcine eyes were obtained and imaged within 24hr post mortem.

A clinical study evaluating the safety and efficacy of accelerated cross-linking began in August 2011. Patients with progressive keratoconus underwent cross-linking under a higher intensity Ultra-Violet (UVA) light of  $10\text{mw}/\text{cm}^2$ .

## **Results:**

To date, the research comparing untreated with CXL and AXL corneas indicates a similar fibrillar appearance of the collagen with SH enhancement dots that may be a consequence of cross-linking. These preliminary results suggest that AXL may be as safe and effective as CXL, with no observed cornea damage despite the higher intensity UV-XTM lamp.

So far, patients keratometry readings (K readings) show a decrease in steepness post accelerated cross-linking. Clinical results to date have been evaluated and findings will be discussed.

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**Corneal cross-linking (CXL) with second harmonic (SH) optical microscopy imaging and accelerated corneal cross-linking preliminary clinical results**

**Conclusion:**

These preliminary results suggest that AXL may be as safe and effective as CXL, with no observed cornea damage despite the higher intensity UV-XTM lamp.

**Acknowledgments:**

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# Fabry's disease and other lysosomal storage disorders: the unique role of optometrists

**Lead Author:** Langis Michaud

Clinique Universitaire de la Vision (É.O.U.M.), Montreal, Canada

## **Purpose:**

To present ocular manifestations as early clinical signs allowing the screening of MPS 1 and Fabry's disease.

## **Methods:**

Lysosomal storage disorders are not so rare. Their clinical manifestations are explained with emphasis on the development of MPS 1 and Fabry's, two life-threatening diseases. The presence of specific ocular manifestations is presented as key elements in the screening of these diseases. Optometrists' unique role through the importance of conducting a slit lamp exam is emphasised. Early screening and timely diagnosis can save a life.

## **Results:**

Clinical pictures and manifestations of MPS 1 and Fabry's disease are presented. These elements come from a cohort of 38 patients followed at Université de Montréal, École d'optométrie. A new clinical finding, TOPS (tortuosité de la paupière supérieure, or crookedness of the upper eyelid) is presented.

## **Conclusion:**

Optometrists can play a unique role contributing to early diagnosis of patients affected with lysosomal storage disorders. By identifying ocular manifestations specific to these diseases, optometrists can assume their primary care role and can contribute to save someone else's life.

## Clinical comparison of hydrogen peroxide to cold chemical PHMB solutions for the care of gas permeable contact lenses

**Lead Author:** Langis Michaud

Clinique Universitaire de la Vision (É.O.U.M.), Montreal, Canada

### **Purpose:**

To compare the effects of two different contact lens care systems on contact angle, visual acuity, contrast sensibility and aberrometry in rigid gas permeable (RGP) contact lens wearers. A questionnaire to assess subjective outcomes was also included in the protocol.

### **Methods:**

The trial spanned over 60 days, with a randomized cross-over design. Boston Simplus (Polymer Technology, Rochester NY) and Clear Care (Ciba Vision, Duluth GA) were used for 30 days each. Clinical data and ocular health assessments were conducted at days one and 30 for each solution. Comfort, dryness and vision in variable settings were subjectively rated on 0-10 scales.

### **Results:**

18 subjects were recruited and 15 completed the study. Data analysis demonstrated no statistical difference ( $p>0,05$ ) for visual acuity (ETDRS), contrast sensibility (Pelli-Robson) and higher order aberrations (iTrace, Tracey Technologies, Houston Tx) after 30 days with either contact lens care system. However, contact angles were significantly increased after 30 days of using Boston Simplus whereas using the Clear Care system yielded no change. Furthermore, contact angles after 30 days of use were also significantly smaller when using the peroxide-based solution. Subjective appreciation analysis showed no statistical difference in distance, near and night vision, ease of use, initial comfort and comfort at the end of the day. Either solution came equally recommended. However, 11 of the 15 preferred the Clear Care system.

### **Conclusion:**

The peroxide-based contact lens care solution not only equalled the multipurpose solution in terms of clinical variables, but also allowed for significantly smaller contact angles when compared to a multi-purpose solution for RGP lenses. In that perspective, hydrogen peroxide, without a rubbing step, seems to preserve the plasma treatment more than a regular care regimen for gas permeable and rigid lenses. The Clear Care system thus presents itself as a favourable alternative to RGP lens wearers.

# Evaluation of sodium hyaluronate lubricating drops used before insertion of contact lenses on symptomatology, severity and intensity of ocular dryness

**Lead Author:** Langis Michaud

Clinique Universitaire de la Vision (É.O.U.M.), Montreal, Canada

## **Purpose:**

This study aimed to evaluate the objective and subjective effects of a lubricating drop (sodium hyaluronate- SH) instilled before the insertion of contact lenses in a population of contact lens wearers symptomatic of dry eye.

## **Methods:**

This was a multi-centre study (five sites) coordinated by l'École d'optométrie de l'Université de Montréal. Subjects were randomly assigned to one of the following groups, based on the care regimen used: group A (Complete, AMO), group B (Optifree Replenish, Alcon), group C (Renu, Bausch & Lomb) or group D (Clear Care, CIBA Vision). During the first month, they followed the manufacturer's recommendations for the care of the lenses, while during the second month, they were asked to put a drop of SH-based comfort drop in the lens before insertion into the eye.

## **Results:**

### **Clinical findings:**

Corneal staining and conjunctival hyperemia were significantly reduced after the use of SH drops ( $p= 0,0357$ ) and TBUT value, on the same individual, was significantly increased from V1 to V2 ( $p=0,05$ ).

### **CLDEQ Questionnaire:**

- Discomfort (Q4): on average, there was a 10% decrease of subjects reporting to be uncomfortable with their lenses V2 (chi square,  $F(4,61)= 5,16$ ;  $p=0,0353$ ).
- Eye dryness (Q5): on average, subjects reported fewer symptoms of ocular dryness while wearing contact lenses with the use of SH drops (chi square,  $F(4,61)=20,2312$ ,  $p<0,0001$ ).
- Blurry vision (Q6): the use of SH drops helped to reduce almost by half the number of subjects symptomatic of blurry vision during their contact lens wear.
- Eye soreness and irritation (Q7): there was a two-thirds reduction of this symptom with the use of SH drops. This difference is highly significant at the end of the wearing time (Q7d,  $p=0,0002$ ).
- Discomfort leading to lens removal (Q13): the use of SH drops helped to reduce the discomfort leading to lens removal, especially at the end of the day (50% improvement).

**Overall preference:** Nine out of 10 subjects recommended the care regimen with SH drops (58.3% strongly and 30% certainly).

**Conclusion:** The use of SH-based drops (Blink™), before insertion, addresses the two major reasons why contact lens wearers drop out from the market (discomfort, blurry vision). SH drops are compatible with every care system regularly prescribed to wearers and their effect is the same regardless of the product used. The use of SH drops before insertion should be considered an essential step to improve overall contact lens performance for every symptomatic contact lens wearer.

## Influence of induced astigmatism on reading performance

**Lead Author:** Matjaž Mihelčič

**Co-Author:** Tabita Opsenica

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### **Aims:**

To functionally test the influence of induced astigmatism on reading performance.

### **Methods:**

Forty adult fully distance corrected subjects were recruited for the test. Text with random words was printed on plates and introduced to subjects. It had to be read aloud, with i) no extra correction (presbyopes got spherical add, according to their accommodative amplitude), ii) with 1,0 D induced against the rule (ATR) astigmatism and iii) with 1,0 D induced with the rule (WTR) astigmatism. The induced astigmatism was always done by means of Jackson cross-cylinders (JCC) +/- 0,5 D. The time to read was one minute and the number of words successfully read was noted.

### **Results:**

As expected, induced astigmatism notably affected reading performance and the difference between both test conditions with induced astigmatism was significant. The reading efficiency (in words per minute) between ATR and WTR induced astigmatism was statistically highly significant (two-tailed t- test,  $p < 0,01$ ); in the condition with induced ATR astigmatism (JCC at  $180^\circ$ ) the reading performance dropped less, whilst WTR induced astigmatism caused a more significant drop in performance. Subjects were also divided into "non presbyopic" ( $< 35$  years) and "possibly presbyopic" ( $> 35$  years) groups and then baseline results were compared with both ATR and WTR induced astigmatism results. In this case, the highest level of significance (t-test,  $p = 0,003$ ) was reached in the group of presbyope subjects with induced WTR astigmatism. Other subgroups reached statistical significance too (CI 95%).

### **Conclusions:**

The results showed that functional astigmatism under reading circumstances does change in the direction of WTR (induced WTR with JCC at  $90^\circ$  decreased reading performance more), even more so in a presbyopic population. The reasons might be either due to known physiological changes of the optical system of the eye or due to the fact that astigmatic error in ATR direction is less disturbing in reading of standard latin script. These results encourage practitioners to check for near astigmatism when near glasses are prescribed.

# Modification of the osmolarity with the use of contact lenses in omafilcon a and methafilcon a materials

**Lead Author:** Giancarlo Montani

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## **Objective:**

The purpose was to evaluate the effect of contact lenses (CL) made of different materials on tear osmolarity (TO) in a group of patients with moderate dry eyes.

## **Method:**

Fifty patients between 18 and 42 years of age with no disease of the anterior segment, no prior use of CL and no contraindication for CL use were selected. The refractive error was similar in both eyes and included between -1,00 dt and -4,00 dt to maintain a similar thickness of contact lenses used. The TO was measured using the TearLab™ and the patients that were selected had a TO between 308,2 mOsm/L and 328,2 mOsm/L, which represents an interval that can be considered associated with marginal dry eyes with no significant difference in both eyes. Afterwards the right eye of all patients was fitted with a lens in Omafilcon A material (Hema +PC) hydration 60% and the left eye with a lens in Methafilcon A (Hema +MMA/EGDMA) hydration 55%. After seven hours of wear, before removing the lenses, we measured the TO and the comfort using a NRS divided into ten steps from 0 (not tolerable) to 10 (excellent comfort) in both eyes.

## **Results:**

The average of TO in the right eye was 323 mOsm/L ( $SD\pm 4,3$ ) before CL fitting and 325 mOsm/L ( $SD\pm 13.3$ ) after fitting for the Omafilcon A CL, with an insignificant difference between the measures for the t test ( $p=0.17$ ). In the left eye the average TO was 323 mOsm/L ( $SD\pm 4$ ) before CL fitting and 340 mOsm/L ( $SD\pm 15.64$ ) after fitting for Methafilcon A CL, with a significant difference between the measures for the t test ( $p<0.001$ ). A low correlation was found between TO and comfort of CL used ( $r^2=0,178$  for Omafilcon A lenses and  $r^2=0,16$  for Methafilcon A lenses).

## **Conclusion:**

The results indicated that lenses made of different materials can have a different impact on the TO. Since a low correlation was found between comfort and TO, one can think that its increase is not the major factor that determines a CL wearer's discomfort. In conclusion the measurement of TFO can help clinicians to identify materials that increase TO least.

## Why study optometry? What motivates student choice of optometry as a career?

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**Co-Authors:** Arnold JS Cochrane<sup>2</sup>, Leon N Davies<sup>3</sup>, Clare O'Donnell<sup>4</sup>, E Ian Pearce<sup>5</sup> and Ellen Fletcher<sup>1</sup>

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### **Purpose:**

To investigate student motivation and the factors influencing the choice of optometry as a career.

### **Methods:**

An online questionnaire was developed, using focus groups and a pilot project on a small cohort of students. Questions were grouped into: personal data, university application, why optometry, student experience, pre-registration application, future career. Students from five UK University optometry-training departments (Aston, Cardiff, Glasgow, Manchester, Ulster) were recruited. 436/1185 (36.8%) responses were obtained within the study period.

### **Results:**

Personal data: 75.7% of respondents were female; 84.6% within age range 18-23 years; 59.2% White British/Irish, 18.6% Asian British; 14.4% had previous degree. University application: All students felt qualifications were most important for UCAS application, followed by personal statement and work experience. Strong influences on choice were reputation of university or course, liked the university or city, visited university, closeness of university location to home. Another relative at the university, a previous family member having studied at the university or family/friend recommendation were weak influences. Why optometry: Optometry first choice for 78.9% of students. Strong influences were wanting: to work in a well-respected profession, to help people, to have good career opportunities, to have a well-paid job, to do a science-based course, to work with people. Weak influences were: always wanted to be an optometrist, optometry useful as starting point for other courses. Student experience: Student motivation for optometry at start of course was very strong for 78.7% of students, although 3.7% of students expressed weak or very weak motivation. 24.3% of students have considered changing courses from optometry at some point during their studies. Pre-registration application: 18/133 students had hospital pre-registration positions. Strong influences were: domestic/personal circumstances, working conditions, career and promotion prospects, reputation of hospital/practice, advice from others. Weak influences were: hours of work, salary on graduation, inclination before optometry course, particular tutor or lecturer. Future career: In five years, 30.5% expect to be working in a multiple, 22.2% in a small/medium chain, 14.9% in hospital, 12.6% in independent practice, 11% opening own practice.

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**Why study optometry? What motivates student choice of optometry as a career?**

**Conclusions:**

UK student optometry population is a diverse body, representing many parts of the UK population and with various educational backgrounds. Students choose optometry for many reasons, and are influenced by both intrinsic values such as wanting to help people, and extrinsic factors, such as personal financial reward. Students are well-motivated, but a surprising number consider changing to another course. They have diverse expectations for future employment.

## Decreasing the load on the hospital eye service by using local optometric services

**Lead Author:** Shehzad Naroo

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### **Background:**

When hospital services are oversubscribed patients are placed on to waiting lists which indicate an imbalance between supply and demand. In the 1980s and 1990s, UK waiting times for procedures such as cataract surgery could be 30-40 months, leading the government to introduce waiting time targets. The waiting list initiative schemes are used to lessen the burden by using independent providers to carry out outpatient appointments and surgery.

### **Methods:**

Data was collected from patients attending outpatient clinics over a 12 month period. Patients had been referred to the hospital eye service (HES) by their doctor or optometrist. Patient data was collected by the clinic staff and information was available in the form of clinic lists, outcome lists and letter to GP or onward referral letter. This included reason for appointment (e.g. new patient, follow-up), outcome and recall period (if necessary). Only data from those patients classed as new patients was used in order to ensure patients did not appear multiple times in the data analysis.

### **Results:**

Data from 3051 patient visits was obtained. From this 1449 patients were classed as new patients and therefore were included in the results analysis.

The mean age of patients was  $61.4 \pm 19.8$  years and 57.0% were female. Patients' ages ranged from five months to 99 years.

Patients were classified under their primary diagnosis or the condition for which they were to first undergo treatment. The World Health Organisation's (WHO) classification was used to group disorders by their location; additionally 23 patients had no apparent eye disorder, therefore a thirteenth group was added to classify these patients. The results showed that the most common presenting conditions were lens and eyelid, lacrimal system and orbit abnormalities.

39% of patients were listed for day case surgery. These included phaco-emulsification, lid lesion removal, iridotomy and laser for posterior capsular opacification. 15% of patients were recalled for a follow-up outpatient appointment.

Further referrals consisted of 44 patients referred to specialist eye clinics, 19 patients referred to hospital non-ophthalmic services, 107 referred for further ophthalmic investigations and 14 patients referred to other eye care professionals (orthoptists and optometrists). 27% of patients were discharged back to the care of their optometrist and 4.4% of patients did not attend their appointment.



# Ocular dominance in golf

**Lead Author:** Shehzad Naroo<sup>1</sup>

**Co-Authors:** Michel Guillon<sup>2</sup>, Kristine Dalton<sup>1,2</sup>, Cecile Maissa<sup>2</sup>

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## **Purpose:**

Judging distance and reading greens in golf require binocular vision, however putting upon optimising Vernier acuity for the alignment of both the ball with the target (ball alignment) and the club with the ball (address). The precision required in putting demands that these tasks be performed monocularly with the dominant eye, in order to minimise errors due to parallax and binocular rivalry. The aim of this study was to assess ocular dominance when aligning the ball (primary gaze) and when addressing the ball (putting gaze).

## **Methods:**

This study investigated pointing ocular dominance in both primary and putting gaze positions on 27 golfers (12 amateur, six club pro or equivalent, nine elite (European Tour pro)). All players were right handed golfers.

## **Results:**

The results showed that:

- 70% of golfers were right eye dominant, 26% were left eye dominant and 4% had no ocular dominance
- Ocular dominance change from primary to putting gaze is similar at all skill levels
- Ocular dominance in primary gaze is of limited predictability of ocular dominance in putting gaze
- No correlation between primary gaze ocular dominance and hand dominance (Pearson  $r = 0.207$ ,  $p = 0.343$ )
- No correlation between putting gaze ocular dominance and hand dominance (Pearson  $r = -0.243$ ,  $p = 0.265$ )

## **Conclusions:**

This study has shown that ocular dominance differs markedly in primary (ball alignment) and putting (address) gazes. Therefore, it is imperative that coaches assess golfers' ocular dominance in both primary and putting gaze positions.

## Body balance in adults with binocular vision disorders

**Lead Author:** Paweł Nawrot

**Co-Author:** Anna Przekoracka-Krawczyk

Laboratory of Vision Science and Optometry, The Quantum Electronics Laboratory, Faculty of Physics, Adam Mickiewicz University, Poznań, Poland

### **Purpose:**

The aim of the study was to investigate body balance during quiet stance in adult subjects with binocular vision disorders, when viewing monocularly and with eyes closed.

### **Methods:**

A posturography platform was used to examine posture in quiet stance. The subject was asked to fixate the target at 150cm. Postural control was evaluated during the following three trials of protocol: monocular viewing with dominant (fellow) eye (DE), nondominant (strabismic) eye (NDE), and with eyes closed (EC). Sixteen subjects (three men and 13 women) with binocular vision disorders joined an experimental group (E) and 30 subjects (10 men and 20 women) without any binocular vision problems, dyslexia, or neurology diseases joined a control group (C).

### **Results:**

The median values of all analysed parameters of posture showed that, when compared to the control group, the postural stability in subjects from the experimental group was weak during quiet stance both in monocular vision and with eyes closed. The following parameters were checked: X standard deviation (DE 0.25 cm vs 0.35 cm; NDE 0.24 cm vs 0.36 cm; EC 0.30 cm vs 0.44 cm,  $p < .005$ , for C and E group respectively), Y standard deviation (DE 0.41 cm vs 0.63 cm; NDE 0.44 cm vs 0.54 cm; EC 0.45 cm vs 0.66 cm,  $p < .005$ , for C and E group respectively), Area Rectangular (DE 3.35 cm<sup>2</sup> vs 7.67 cm<sup>2</sup>; NDE 3.12 cm<sup>2</sup> vs 6.85 cm<sup>2</sup>; EC 5.11 cm<sup>2</sup> vs 8.34 cm<sup>2</sup>,  $p < .005$ , for C and E group respectively), Area of the 95th percentile ellipse (DE 1.71 cm<sup>2</sup> vs 4.36 cm<sup>2</sup>; NDE 2.02 cm<sup>2</sup> vs 3.79 cm<sup>2</sup>; EC 2.71 cm<sup>2</sup> vs 5.06 cm<sup>2</sup>,  $p < .005$ , for C and E group respectively).

### **Conclusions:**

When compared to the control group, the subjects with binocular vision disorders showed weak postural stability during quiet stance when looking at 150cm. The results suggest that subjects with binocular vision disorders have problems with body balance and motor functioning even when looking with their fellow eye. Similar results were observed in trials with eyes closed, which may suggest that weak postural stability in the experimental group does not depend on visual information.

# Effect of form defocus and stimulus contrast reduction on the dynamic accommodative response

**Lead Author:** Mireia Pacheco-Cutillas

**Co-Authors:** S. Martin, R. Borrás, N. Lupon, H Abril

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## **Purpose:**

It has been shown that retinal defocus may act as a signal which can influence a number of visual processes from refractive error development to depth of focus perception. This study investigated the effect of form defocus and stimulus contrast reduction on the accommodative response by means of recording microfluctuations.

## **Methods:**

Forty five young adults (mean age:  $21.6 \pm 2.2$  yrs), with no ocular pathology, accommodative/binocular dysfunction, or uncorrected significant refractive error, viewed a VA=1M test binocularly at 33cm. The dynamic accommodative responses were recorded using a photorefractor (PowerRefractor, PlusOptiX, Germany) under three experimental conditions. In order to study the effect of defocus, 0.8 Bangerter and 0.50 D Gaussian filters were used to blur the stimulus presented and to investigate the effect of low contrast. A 11% contrast Webber test was designed. Subjects viewed a AV=1M test binocularly at 33cm and results were compared with the accommodative responses under normal conditions.

## **Results:**

The results of the accommodative responses were analysed using the mean accommodative response and the amplitude of fluctuation, by means of RMS and a Power Density function (Fast Fourier Transform algorithm). Absolute values for the low frequency component (LFC) region (0.1–0.6 Hz) and the high frequency component (HFC) region (1–2.3 Hz) were obtained.

The accommodative response was significantly reduced by the effect of defocus produced with a Bangerter filter (ANOVA post-hoc,  $p < 0.05$ ), but not with the Gaussian filter or the low contrast stimulus. The magnitude of the accommodative microfluctuations (RMS) also increased with the Bangerter filter although not significantly, compared to the other experimental conditions ( $P = 0.18$ ). No further significant differences were found for the low (LFC) or high (HFC) frequency components of the microfluctuations of the accommodative response for any of the experimental conditions.

## **Conclusions:**

The reduced accommodative response observed by the effect of defocus induced with the Bangerter filter suggests a poorer control of the accommodative response under this condition. This study suggests that the effect of the defocus generated by the Bangerter filter is intrinsically different to that generated by the Gaussian filter and the low contrast stimulus since the Bangerter filter does not only produce axial defocus, but also peripheral defocus, which could have a further detrimental effect on the accommodative response.

## **“A little learning is a dangerous thing” (Alexander Pope 1709): educating towards standardisation in optometry**

**Lead Author:** Dinah Paritzky

Hadassah College Jerusalem, Israel

### **Purpose:**

To present a program for re-educating non-qualified and poorly educated “optometrists”.

### **Background:**

The different standards of education and regulation of optometry throughout the world are a well-known problem. In Israel the Law of Optometry (1991), defines an optometrist as someone who has a degree in optometry and who has also passed the Ministry of Health licensing exams. There are currently two academic institutions teaching four year optometry programs: Bar-Ilan University and Hadassah College, both of which began their programs in 1996.

Both prior to and post 1991, a non-accredited college (The College of Vision Science) ran an optometric education program. Since this program did not grant an academic degree, their graduates were unable to take the licensing exams. Hundreds of these graduates have been working illegally as optometrists. The Israeli parliament asked Hadassah College to create a program for these practising “optometrists” that would grant them a B. Optom., thus enabling them to take the licensing exams.

### **Challenges:**

The average age of the group was 35, compared to 22 for the regular undergraduate students and the majority had not participated in formal studies for many years. In addition, there were no entrance requirements to the program other than the fact that they had studied optometry at the College of Vision Science. All the students were employed full-time, and often were the primary wage-earner of the family.

There was opposition from the students themselves: having been practising as optometrists, many believed they were taking the degree for “political and bureaucratic” reasons rather than didactic and clinical ones.

### **Solutions:**

A number of solutions dealt with the various challenges. After reviewing the syllabus for the College of Vision Science, an academic committee decided on a course of studies of 154 credits (as opposed to 205 in the regular degree). In addition, the required English level was lowered.

A faculty member was appointed to be responsible for this group, to co-ordinate with the Optometry Department and deal with problems. Extra tutorials were scheduled. All lectures and labs took place on 1.5 consecutive days, for three semesters, each year. Clinic rotations took place daily, according to individual student’s requests.

### **Outcome:**

Forty five students were initially accepted, 23 of whom dropped out during the first week, enabling us to accept 23 others from the waiting list. Out of the 39 students who finished the first semester, 34 finally graduated and have since received their optometry license.

# ***In vivo* measurement of scleral thickness in humans using anterior segment optical coherent tomography (AS-OCT)**

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**Co-Authors:** Bernard Gilmartin<sup>2</sup>, Robert Cubbidge<sup>2</sup> and Nicola Logan<sup>2</sup>

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## **Purpose:**

The study examined the reliability of the AS-OCT in measuring anterior scleral thickness (AST) and evaluated the variation of AST for different meridians and distances from the corneolimb junction. To identify putative correlates of AST, the data was examined with reference to refractive status, ethnicity and gender.

## **Methods:**

The subject group comprised 75 individuals (29 males; 46 females; 37 emmetropic; 38 myopic; British White n=49; British South-Asian n=26). Scleral cross-sections were imaged for each subject using an AS-OCT (Visante; Zeiss). Images were sampled twice in random order in 8 meridians: (superior (S), inferior (I), nasal (N), temporal (T), superior-temporal (ST), superior-nasal (SN), inferior-temporal (IT) and inferior-nasal (IN)). Using the callipers provided by the Visante software, manual measures of AST were taken in 1mm anterior-to-posterior steps from the corneolimb junction over a 7mm distance (the A-P distance); respective meridians were assessed in a random order. Axial length and refractive error measurements were taken with, respectively, an IOLMaster biometer (Zeiss) and a Shin-Nippon autorefractor (Ryusyo Industrial Co. Ltd). Intraobserver variability was examined by having one examiner evaluate seven images for each of the eight meridians for one subject. Interobserver variability was evaluated by having two examiners measure AST in eight meridians of 11 subjects. Mixed repeated measures ANOVAs tested meridional and A-P distance differences in AST, gender, refractive status and ethnicity. Measures of coefficient of variance (CoV) and intraclass correlation coefficients (ICC) for each meridian and A-P distance were used to evaluate intra- and inter-observer variability.

## **Results:**

Significant ( $p < 0.001$ ) differences between meridians was found for AST; SN was the thinnest meridian and I the thickest; post-hoc testing demonstrated significant differences between all meridians except between S:ST, I:IN, IT:N and IN:N. A significant difference was found for A-P distances ( $p < 0.001$ ); post-hoc testing showed significant differences between all A-P distances except between 1mm and 6mm and between 2mm and 4mm. CoV showed significant differences between meridians ( $p < 0.007$ ), but not between A-P distances ( $p = 0.468$ ). ICC showed no significant difference between meridians ( $p = 0.272$ ) or A-P distances ( $p = 0.177$ ). AST was found to be significantly greater ( $p < 0.001$ ) in male subjects. No significant difference ( $p = 0.119$ ) was found between refractive status ( $p = 0.119$ ) and ethnicity ( $p = 0.125$ ).

## **Conclusion:**

Intra- and inter-observer reliability for AST measurements was good for all meridians and A-P distances. Information on the nature of meridional variation in AST will provide a reference for selecting the optimal site for drug delivery via intracameral injection and hence potentially reduce the attendant risk of sclera perforation.

## Enhanced optometric services in the UK: a review

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With an ageing population we can expect to encounter more age related eye problems such as cataract, glaucoma, macular degeneration and subsequently a greater demand on secondary eye care services. Optometrists based in the community possess the skills and access to modern equipment to provide a comprehensive service in the primary care sector. Over the last two decades this has been increasingly utilised to develop enhanced optometric services whereby eye disease is managed or monitored in the community setting. This allows the best use of professional time and expertise, alleviates the burden on the hospital eye service, and provides improved eye care locally and at the patient's convenience.

In Herefordshire, for example, there are very well established shared care schemes in place. These include the direct cataract referral, postoperative cataract assessment, low vision assessment, GP eye referral and suspect glaucoma referral refinement schemes. A 'Children's Assessment Scheme' has recently been trialled and it is envisaged that an assessment and referral pathway for macular degeneration will be in place in the near future. Enhanced services comparable to these exist throughout England and Wales and aim to achieve the same goals. However, there are no national templates as current protocols are tailored specifically for the local region.

The enhanced services are set out as an arrangement between the local contractors/performers and their primary care trust and a separate fee is applied. The cost of the services is negotiated with the primary care trust and so often varies across the country. In this respect, eye care in Scotland has taken an alternative approach as the Scottish health authorities provide a fixed fee for all optometric services provided in the primary care arena. Both systems result in financial savings for the health authority, however there is limited literature investigating and comparing their cost effectiveness.

This work aims to outline the enhanced optometric services that exist throughout the UK, with specific goals such as identifying and redefining cost effective enhanced optometric patient pathways. The end result should lead to a better economical understanding that helps to develop a business model geared towards optometric practice.

# The Mozambique Eyecare Project – addressing uncorrected refractive error in Lusophone Africa through optometric education

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**Co-Authors:** Prof Kavin Naidoo<sup>2,3,4</sup>, Dr Luigi Bilotto<sup>2,3</sup>, Mr Prasad Ramson<sup>2,3</sup>, Mr Stephen Thompson<sup>2,3</sup>, Dr James Loughman<sup>1,3</sup>

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<sup>4</sup> University of KwaZulu Natal, South Africa

## **Purpose:**

Mozambique has a population of over 20 million people, with 16 ophthalmologists and no optometrists, eyecare service provision is extremely rare in most areas of the country

Dublin Institute of Technology, Universidade Lúrio, Mozambique and University of Ulster are collaborating with the International Centre for Eyecare Education, in the implementation of the Irish Aid Funded “Mozambique Eyecare Project” (MEP). The MEP aims to provide a sustainable solution to the problem of avoidable blindness in developing nations by addressing local human resource capacitation through optometric education. The MEP intends establishing an integrated programme of optometric education and vision-care services delivery.

## **Methods:**

The Optometry Programme in Universidade Lúrio has come about as a result of joint collaboration in the following areas:

- Programme Development
- Programme Monitoring and Evaluation
- Curriculum Development
- Research Themes
- Operational Methods

## **Results:**

Successful collaborative efforts within the project include

- Awarded a 1.5 million grant from Irish Aid, monies also secured from Dublin Institute of Technology and ICEE funders
- 55 undergraduate students enrolled in the Optometry Programme
- Development of a university optometric training clinic
- Curricular model adapted in line with the Higher Education Reform in Mozambique
- Involvement of the National Eyecare Coordinator in curriculum approval process as an initial stage in cadre recognition by Mozambican Ministry for Health MISAU
- Recognition by MISAU that the model will address the immediate need for optometric human resources
- Recruitment of five post graduate students to research the model.

## **Conclusions:**

Cross institutional collaborations work effectively and efficiently to establish optometry education programmes to address uncorrected refractive error. While critically increasing the optometric human resource capacity within Mozambique and potentially lusophone Africa, the programme will establish research infrastructure which will generate specialist knowledge. This knowledge will be used to influence policy and facilitate the implementation of sustainable systems in the developing world.

## Primary school vision screening involving teachers in Nampula, Mozambique

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### **Purpose:**

There is no plan for a national child eye care programme or existing human resource infrastructure to address the immediate challenge of child eye health in Mozambique. Furthermore, the prevalence and incidence of refractive error, visual impairment (VI) and child blindness (CB) in Mozambique is unknown. VI and CB have devastating personal, developmental, economic and other implications for the child, the family, the community and indeed, the nation. This study aimed to design, implement and evaluate a school based paediatric vision screening service, to identify those in need of eye health services, among Mozambique's 11,561,000 children.

### **Methods:**

Primary school screening took place in three schools in Nampula, Mozambique in September 2010 and March 2011. The children's vision was screened by an optometry student, optometrist or teacher with a Log MAR 0.3 line at 4 meters. Ophthalmoscopy was performed on all children. Children who failed to read all 5 letters monocularly had their visual acuity examined on a standard Log Mar chart. If they failed to see the 0.3 line on the standard chart they had a full refraction on site. Children who required refraction were refracted on site. Those needing ophthalmological assessment were referred to Nampula Central Hospital, Ophthalmology Unit.

### **Results:**

770 children were screened in total. The ocular abnormality detection rate was 10.65%, with 7.40% requiring spectacle provision, and 3.25% requiring referral to the Ophthalmology Unit. The prevalence of myopia, hyperopia and astigmatism was 2.20%, 0.91% and 4.29% respectively. Most common referrals for ocular health abnormalities included cataract (0.91%), ptosis (0.78%) and glaucoma (0.52%). All teachers interviewed indicated an eagerness to participate in a vision screening programme. Two primary school teachers were trained in vision screening. Teachers scored 100% case detection agreement with optometrists and student optometrists, with no noted false positive or false negative referrals.



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### **Primary school vision screening involving teachers in Nampula, Mozambique**

#### **Conclusions:**

The relatively high ocular abnormality detection rate (10.65%) among school children examined in Nampula in this study indicates that there is a need to screen and treat children for uncorrected refractive error and other eye conditions in schools. The benefits to the child, the community and the economy of providing paediatric eyecare services have been well documented. Despite a severe lack of resources the Mozambican Government is improving the standard of primary education and health care for all rapidly. Teachers appear to have an adequate level of education and interest to undertake vision screening in children. The results of this study will inform a regional pilot teacher screening project for Nampula, which will include the addition of “Vision Screening” to teacher training modules at Pedagogical Universities in Nampula, Mozambique, as part of a plan to develop a national child eye care programme for Mozambique.

## Effect of blur on reading performance: monocular vs. binocular vision

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### **Background:**

The purpose of this study was to quantify the effect of dioptric blur on reading performance in a group of normally sighted presbyopes.

### **Methods:**

12 normally sighted presbyopes, with an average age of  $63 \pm 8$  years (range 53 to 72 years) and an average addition for near of  $2.22 \pm 0.31$  D, participated in the study. Reading performance was evaluated using 3 versions of high-contrast Colenbrander cards in the Greek language (Precision Vision, US). Monocular (dominant eye) and binocular measurements were performed at 40cm distance with best refractive correction (in-focus) and at two levels of dioptric blur induced by negative lenses, corresponding to 0.50 D and 1.00 D under-correction for near. Measurements were counterbalanced. For each condition, observers read aloud sentences on one of these charts, from large to small print. Reading time for each sentence and the number of errors made were recorded and converted to:

- (i) reading acuity, i.e. the smallest print in logMAR that the participant can read (+ total number of words read incorrectly  $\times 0.01$  logMAR)
- (ii) maximum reading speed, i.e. the participant's reading speed when reading is not limited by print size
- (iii) threshold print size, i.e. the print size that corresponds to an 80% of the maximum reading speed
- (iv) "newsprint" reading speed, the participant's reading speed at 0.4 logMAR (average newsprint) print size

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**Effect of blur on reading performance:  
monocular vs. binocular vision**

**Results:** Average reading acuity was affected with dioptric blur ( $-0.03 \pm 0.03$  logMAR when in-focus,  $0.05 \pm 0.03$  logMAR at  $-0.25$  D and  $0.14 \pm 0.03$  logMAR at  $-0.50$  D blur) and was better with binocular ( $0.01 \pm 0.02$  logMAR) than with monocular ( $0.09 \pm 0.02$  logMAR) viewing. Two-way ANOVA revealed a statistically significant effect of blur ( $p=0.001$ ) and viewing condition ( $p=0.016$ ), while the interaction between blur and viewing condition was not significant ( $p>0.05$ ). Reading speed remained fairly constant for large print sizes, gradually decreasing as print size decreased. By fitting second order regressions, we found that the maximum reading speed was minimally affected by blur, as was the case for the newsprint reading speed. On the other hand, the average threshold print size decreased from  $0.24 \pm 0.03$  logMAR when in-focus to  $0.32 \pm 0.03$  logMAR at  $0.50$  D blur and  $0.40 \pm 0.03$  logMAR. Two-way ANOVA revealed a statistically significant effect of blur ( $p<0.001$ ) and a marginal insignificance for the viewing condition ( $p=0.07$ ). Bonferroni a posteriori comparisons for reading acuity and threshold print size showed highly significant differences between the in-focus condition and the  $1.0$  D blur ( $p<0.001$ ) but not between the other ( $0.50$  D vs.  $1.00$  D, in-focus vs.  $0.50$  D) blur levels.

**Conclusions:** The similar rates of change with blur for threshold print size and reading acuity suggest that reading performance is susceptible to small amounts of blur corresponding to under-correction for near vision. With binocular vision reading performance is significantly reduced for amounts of blur higher than  $0.50$  D.

## Influence of material and frequency of replacement of selected contact lenses on the tear film stability

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**Co-Authors:** Lenka Musilová, Jiří Bajer

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### **Purpose:**

The aim of this research was to study the influence of different materials and the frequency of replacement of contact lenses on the tear film stability during a one month period.

### **Methods:**

The studied characteristics of contact lenses were represented by daily disposable hydrogel contact lenses Dailies® AquaComfort™, monthly hydrogel contact lenses Frequency XC and siliconhydrogel contact lenses PureVision®. 55 participants were included in the study (35 women, 20 men). The age range of the subjects was 15 to 50 years of age. 20 subjects wore the daily disposable hydrogel contact lenses, 20 subjects wore the monthly hydrogel contact lenses and 15 subjects wore the monthly siliconhydrogel contact lenses. The contact lenses were worn during a 30-day period. The break-up time (BUT) was the parameter of the tear film stability. It was measured before the insertion of the contact lenses on the first day of their wearing and on the first day without the lenses (i.e. after the 30-day period). Each subject wore no contact lenses in the week before the experiment. The significance of the BUT changes was tested statistically by the t-test for the significance level  $p$ .

### **Results/Data:**

Statistically significant decreases of the BUT were proved by the paired one-tailed t-test for all considered contact lenses ( $p < 0.0001$ ). The mutual comparison of the BUT changes was done by the unpaired t-test for all three types of contact lenses. No significant difference was found in the case of the studied types of the monthly contact lenses ( $p = 0.71$ ). The daily disposable contact lenses showed significantly lower changes of the BUT in comparison with both the hydrogel and siliconhydrogel monthly contact lenses (one-tailed unpaired t-test,  $p < 0.046$  and  $p < 0.027$ ).

### **Conclusion:**

A significant deterioration of the stability of the tear film after 30 days of wearing was proved for all considered types of contact lenses. The influence of the replacement schedule was discovered and no influence of the material was discovered. The daily soft contact lenses showed the smallest deterioration of the tear film stability after wearing.

# Binocular dysfunctions in a population with low near vision requirements

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## **Objectives:**

Previous studies had shown strong evidence of a higher prevalence of general binocular dysfunctions in non-presbyopic populations with high demands on near vision. However, only a small number of these studies had assessed this prevalence in populations with low requirements of near vision. Our aim is to determine the type of general binocular dysfunctions that are prevalent in this special population and the differences with other populations with high near vision necessities.

## **Methods:**

An initial group of 47 subjects from North Africa and sub-Saharanans, with ages ranged from 20 to 35 years old participated in this study. From this group, 39 were selected for the study, 22 male and 17 female, 15 Afro-American and 24 Caucasian. Subjects with ocular or systemic pathologies (3), uncorrected refractive errors bigger than 1 D (3) or strabismus and amblyopia (2) were excluded from the study. None of them had been schooled during childhood and, at that time, none of them had high near vision demands. They worked in agriculture, peddling and housekeeping. A complete visual examination (including refraction, ocular health, and binocular and accommodative tests) was performed. The results of each test were compared with the population standards and later they were grouped according to the deviation from the normal values. Finally, the different anomalies were identified.

## **Results:**

The refractive errors of the studied population were 90% hypermetropic (<1 D). The presence of high amplitudes of accommodation is emphasized in accommodative tests, and in the monocular and binocular accommodative facility test 68% had difficulties for clear vision with positives lenses. 12% of people had a reduced near point of convergence and 95% presented with exophoria in binocular tests. The prevalence of general binocular dysfunctions was 5%. Convergence and accommodative insufficiency both had the same prevalence (2.5%). Other dysfunctions appeared but without symptomatology.

## **Conclusions:**

Accommodative and non-strabismic binocular vision problems in this population with low near vision demands are lower than the results obtained in the literature for populations with high visual demands. The near visual effort causes an increase in general anomalies of binocular vision.

## Clinical evaluation of the HRK-7000 autorefractometer based on the Shack–Hartmann principle

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### Background:

The purpose of this study was to evaluate the repeatability and accuracy of a new generation autorefracto-keratometer (HRK-7000, Huvitz) based on the Shack-Hartmann principle. The refractive error is derived from the second order ocular aberrations for a 4mm pupil from a total of 25 lenslets.

### Methods:

Refractive error measurements were obtained from the 43 right eyes of 43 healthy myopes, with a mean age  $28 \pm 6$  years and a mean spherical equivalent of  $-5.07 \pm 2.11$  D and  $-4.86 \pm 2.05$  in the right and left eye, respectively. Measurements were taken subjectively (manifest refraction) by a practitioner and objectively with the HRK-7000 in two conditions: with and without cycloplegia (cyclopentol 1%). In each case two measurements were taken within 30 minutes for estimating the inter-test autorefraction repeatability. Refractive error analysis was performed using Fourier decomposition in three components: mean spherical equivalent (MSE), J0 (astigmatism at  $180^\circ$  or  $90^\circ$ ) and J45 (oblique astigmatism at  $45^\circ$  or  $135^\circ$ ). Agreement between the objective and subjective measurements was evaluated for each component using Bland-Altman analysis. Any statistical differences between the various variables were assessed with paired Student's t-tests and Wilcoxon signed rank tests (when data were not normally distributed).

### Results:

Average test-retest repeatability was  $0.01 \pm 0.19$  D for spherical equivalent ( $p=0.92$ ),  $0.00 \pm 0.09$  D for Jo ( $p=0.69$ ) and  $-0.01 \pm 0.06$  D for J45 ( $p=0.62$ ). In the presence of cycloplegia test-retest repeatability was  $0.01 \pm 0.15$  D for spherical equivalent ( $p=0.48$ ),  $0.02 \pm 0.09$  D for Jo ( $p=0.19$ ) and  $0.02 \pm 0.07$  D for J45 ( $p=0.09$ ). The use of cyclopentolate shifted the spherical equivalent from  $-5.07 \pm 2.11$  D to  $-4.75 \pm 1.99$  D (average difference  $0.32 \pm 0.30$ D;  $p < 0.001$ ).

The results of the objective and subjective measurements of refractive error were similar. More specifically, the average difference between the HRK-7000 and the subjective refraction for the spherical equivalent was  $0.11 \pm 0.32$  D ( $p=0.01$ ) and  $0.24 \pm 0.24$  D ( $p=0.001$ ) without and with cycloplegia, respectively. The differences in astigmatic components Jo and J45 were not statistically significant.

### Conclusions:

The repeatability and accuracy of HRK-7000 are comparable with other clinical autorefractometers. The HRK-7000 forms a reliable objective refractor tool for general optometric practice.

# The curious case of the functionally legally blind patient with 20/25 (6/7.5) visual acuity

**Lead Author:** Joseph A. Pruitt

Minneapolis Veteran Affairs Medical Centre, Minneapolis, MN, USA

## **Background:**

An 86-year old white male presented to the low vision (LV) Eye Clinic complaining of an increased difficulty performing the activities of daily living (ADLs). More specifically, the patient identified improved reading as the primary goal. His history was remarkable for having been diagnosed with non-exudative macular degeneration approximately 15 years prior.

## **Case Report:**

Initial examination revealed best corrected distance acuities of the following: OD: 20/25 (6/7.5), OS: 20/400 (6/120). In addition, Goldmann Visual Field revealed relatively normal results OD, OS, OU. Therefore, given the great visual acuities achieved in clinic by way of the trial-frame refraction, a single-vision reading only prescription was released to address the patient's primary goal. Through the near only prescription, the patient was able to read 0.5 M.

Approximately two months later, the patient's daughter requested the patient be re-examined because the patient "does not act like he has 20/25 (6/7.5) vision." Therefore, the patient was re-examined, but results similar to the initial examination were found. However, due to the patient's daughter's vehement plea that the patient functions like someone with much poorer vision, further investigation was warranted.

Two weeks later, the patient returned to the Low Vision Clinic for the administration of a micro-perimetry field test via the Nidex MP-1 Micro-perimeter. The test results identified a small, 40, central island of retinal sensitivity, which was surrounded by large areas of geographic atrophy. The preferred retinal loci (PRL) located accounted for the visual acuity achieved OD.

## **Conclusion:**

The United States of America Social Security Administration defines "Legal Blindness," also known as statutory blindness, as the following:

*"Visual acuity of 20/200 (6/60) or less in the better eye with the use of a correcting lens or a visual field limitation such that the widest diameter of the visual field subtends an angle no greater than 20 degrees."*

Due to an essentially insignificant PRL, with regards to the correlation between vision and functionality, the patient was not identified as "Legally Blind"; thus was not initially considered to be an individual in need of significant Low Vision intervention. Unfortunately, this proved to be to the detriment of the patient. Therefore, it is crucial that Low Vision practitioners do not limit the care provided by strict adherence to rigid definitions, which inherently lack the capability of being all-inclusive.

## Simple device for improved visual functioning for client with right hemianopic defect

**Lead Author:** Nancy Prussing

**Co-Author:** Joseph Pruitt

Minneapolis Veterans Administration Medical Centre, USA

**Purpose:**

A young Veteran was referred to the abstract author, a Certified O&M Specialist, for evaluation of mobility concerns caused by a right hemianopic defect secondary to a traumatic brain injury. Although Veteran has 20/20 vision and can see well enough to ambulate independently, he is unable to see objects or persons [passing] on his right side due to the hemianopic visual field defect. Veteran was not interested in using a white cane, nor was this recommended as he is not legally blind.

**Methods:**

For the purpose of alerting Veteran to movement on his right side, “rear-view” glasses were created by attaching a dental mirror to the left temple of an old pair of glasses.

**Results:**

Without the glasses and when looking straight ahead, Veteran did not notice an obstacle - or passing pedestrian – until pedestrian or object was about 5-7 feet in front of him. When wearing the glasses, the Veteran could identify pedestrian movement and obstacles when alongside of him.

**Conclusions:**

Although seemingly simple, perhaps the use of specially-placed mirrors, angled or otherwise, could provide a functional improvement to an individual with a field defect. Further assessment or correspondence by qualified professionals is recommended.



# Assessing visual acuities at near with letter and symbol charts: effect of chart type and defocus

**Lead Author:** Sheila Rae<sup>1,2</sup>

**Co-Authors:** Tasanee Braithwaite<sup>2,3</sup>, Daryl Tabrett<sup>2</sup>, Rupert Bourne<sup>2,4</sup>, Shahina Pardhan<sup>2</sup>

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## Purpose:

Standards exist for the design of visual acuity test charts for distance use (e.g. BS 4274-1:2003) to allow calibration of charts for use for certification purposes such as for driving licenses or visual impairment registration. Near acuities are habitually assessed with functional reading based tests which are not scored in an equivalent logMAR or Snellen format (e.g. M series, Jaeger type or N point type). Thus comparison between far and near acuities in individuals and populations is hampered. This study compared near visual acuities with a range of logMAR design charts to an ETDRS far chart and the effect of defocus on visual acuities with each chart.

## Methods:

The near charts (Goodlite, USA) used were all designed for use at 0.4m and had been designed following the principles of Bailey and Lovie (1976) in terms of layout. Each presented five optotypes per line from 1.0 to -0.3 logMAR in 0.1 steps. Four near charts were used: 1) ETDRS chart 1 using Sloan letters; 2) four orientation tumbling E chart; 3) four orientation Landolt C chart; 4) Lea symbol chart with four picture symbols. A 3m internally illuminated ETDRS chart 1 (Precision Vision, USA) was used for comparison to far acuities. Visual acuities were measured in ten subjects following cycloplegia with a 4mm artificial pupil in place. Acuities were measured with optimal refractive correction then with + to -2D added blur in 0.5D steps.

## Results:

Table 1 shows visual acuities for each chart. There were significant differences in best corrected visual acuities between charts (Repeated-Measures ANOVA:  $F=10.622$ ;  $p<0.001$ ). Post-hoc testing showed near visual acuities significantly lower for tumbling E and Landolt C near charts compared to far ETDRS but no difference between near ETDRS, Lea symbol and far ETDRS charts. The near ETDRS chart gave significantly better acuities than the near Landolt C or Lea symbol charts. All four near charts showed less drop in acuity with added minus than plus blur (Figure 1) with a significant difference between rate of decrease in acuity with plus vs. minus blur for ETDRS and Landolt C charts (paired samples t-test:  $p<0.05$ ).

**Conclusions:** Although allowing comparable results between far and near visual acuities, the charts tested all showed poorer acuities at near despite best correction and fixed pupil size. The difference in rate of drop in acuity with added minus vs. plus blur suggest a greater tolerance to defocus caused by under-corrected presbyopia.

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**Assessing visual acuities at near with letter and symbol charts: effect of chart type and defocus**

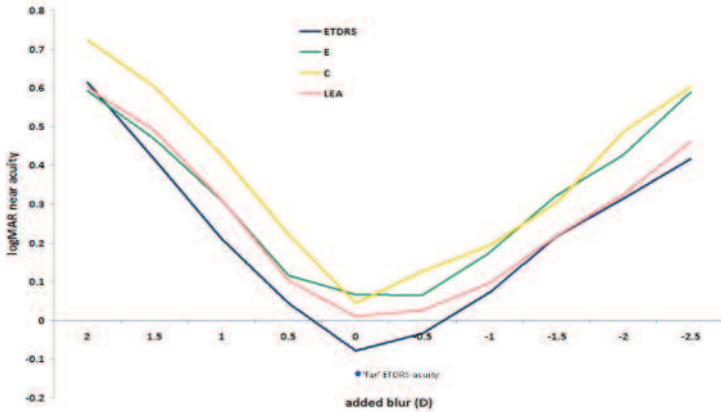


Table 1. Mean LogMAR visual acuities with each chart

Chart	LogMAR best corrected visual acuity (SD)
3.0m ETDRS	-0.14 (0.09)
0.4m ETDRS	-0.08 (0.11)
0.4m E	+0.11 (0.22)
0.4m C	+0.05 (0.14)
0.4m LEA	0.00 (0.17)

# Community screening for eye health problems, a horizontal integrated programme for eye health and the promotion of better vision

**Lead Author:** Supaluk Raiyawa

Optometry Department, Rungsit University, Thailand

## Objective:

The promotion of eye health and better vision and the prevention of avoidable eye problems are a part of community eye health. This project created a screening programme for eye diseases and refractive error in a rural community in north-east Thailand. Complete eye health and vision care services were established and delivered to the community population in an integrated package programme.

## Method and setting:

A community screening and survey programme to identify eye disease and vision problems in the population aged 40 and over was set up at a community health centre. Visual acuity and ocular tension were examined and complete eye examinations were conducted. The results were gathered and analysed. The diseased patients were treated and referred to hospital for long term and complete care. All patients also received eye health education.

## Conclusion:

The most frequent problem was cataract, followed by pterygium, refractive error and presbyopia. Other conditions with high rates of prevalence were glaucoma and ocular hypertension. Every individual was given treatment according to their diseases or problems.

**Table 1:** The prevalence of eye health diseases found in the community

	<b>FACTORS</b>	<b>N(Percent)</b>
<b>Valid</b>	blepharoconjunctivitis	153(4.6)
	eye ache	153(.7)
	glaucoma	153(3.3)
	macular dystrophy	153(.7)
	macular hole	153(.7)
	normal	153(11.8)
	NPDR	153(2.6)
	ocular hypertension	153(2.0)
	PDR	153(.7)
	presbyopia	153(6.5)
	pseudophagia	153(1.3)
	pterygium	153(16.3)
	refractive error	153(9.2)
	retinal degeneration	153(.7)
	SIC	153(37.9)
	XT c amblyopia &DR	153(.7)
	missing	153(.7)
<b>Total</b>	<b>153(100.0)</b>	

**Table 2:** The prevalence of refractive error found in the community

		<b>N(Percent)</b>
<b>Valid</b>	No refractive	153(44.4)
	pure refract	153(9.2)
	refractive error from SIC	153(32.0)
	refractive error from pterygium	153(3.9)
	refractive error from other cause	153(2.6)
	refractive error from presbyope	153(6.5)
	<b>Total</b>	<b>153(98.7)</b>
<b>Missing</b>		153(1.3)
<b>Total</b>		<b>153(100.0)</b>

# Reliability and repeatability on intraocular lenses optical characterization by the Kaleo system

**Lead Author:** Laura Remón<sup>1</sup>

**Co-Authors:** Josefa Benlloch<sup>2</sup>, Manuel Rodríguez-Vallejo<sup>2</sup>, Juan Antonio Monsoriu<sup>1</sup>, Walter D. Furlan<sup>2</sup>

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## **Purpose:**

To assess the intra-session repeatability and inter-session / inter-experimenter reliability of the Kaleo System (Phasics S.A.) on optical parameters in accordance with the ISO 11979-2 norm.

## **Methods:**

Kaleo's (Phasics S.A.) repeatability and reliability were evaluated using a package of ten monofocal hydrophilic IOLs (power ranging from 11 to 31D) provided by AJL Ophthalmic SA. Measurements of power, modular transfer function (MTF), and cut-off frequency for each IOL were performed in accordance with the ISO 11979-2 Norm (3 mm aperture and with 100 mm<sup>-1</sup> spatial image frequency). Three consecutive measurements for each IOL were developed without changing the cell position in order to describe the variability due to the instrument (intra-session repeatability). For inter-experimenter's reliability, the IOLs package was measured by two experimenters in 3 consecutive days in order to test the influence of the operator in handling the instrument. Finally, inter-session variability was estimated with the measurement of the 10 IOLs in 3 consecutive days by the same experimenter. Statistical analysis was performed using Statistical Product and Service Solutions (SPSS 17.0) for Windows software. All p-values obtained in the study followed a normal distribution ( $p > 0.05$ ) with Kolmogorov-Smirnov & Shapiro-Wilk test.

## **Results:**

The Intraclass Correlation Coefficient (ICC) for the intra-session repeatability was 0.998 (CI 95%: 0.996-0.999) for Power; 0.895 (CI 95%: 0.831-0.939) for the MTF and 1.0 (CI 95%: 1.0-1.0) for the cut-off frequency. For inter-experimenter reliability CCI values decreased to 0.996 (CI 95%: 0.994-0.998) in Power; 0.799 (CI 95%: 0.666-0.882) in MTF and 0.984 (CI 95%: 0.971-0.991) in cut-off frequency. Finally, inter-session reliability CCI values were 0.998 (CI 95%: 0.996-1.0) in Power; 0.626 (CI 95%: 0.248-0.878) in MTF and 0.977 (CI 95%: 0.936-0.994) in cut-off frequency. In accordance with optical quality, the MTF values remained constant for powers up to the limit of +24 D, at this point modulation began to decrease. In particular, MTF values for 27D, 28D and 33D were under 0.43 (requirement of the Norm 11979-2 at a frequency 100 mm<sup>-1</sup> and 3 mm in aperture).

## **Conclusion:**

Our results confirmed an excellent intra-session repeatability for all the variables related with optical quality in accordance with ISO 11979-2. If the cell position had not been handled by the experimenter it would not be necessary to do more than one measure of the IOL optical quality. The power measurements using the instrument showed a good level of reliability although the MTF value was more variable. We consider that it is necessary to assess optical quality of IOLs on different days to be sure there are not changes in their values measured with the Kaleo System.

# Achieving independent prescribing status as an optometrist: steps, costs, processes and outcomes

**Lead Author:** Nicholas Rumney

BBR Optometry, Hereford, UK

## **Purpose:**

To describe the progression of a registered optometrist to full independent prescribing status in one year.

The WCO Global Competency Based Model of Scope of Practice in Optometry has addressed the diversity in optometric qualifications by establishing a four step ladder of qualification, starting with dispensing optics with refractive and investigative functions and gradually increasing the scope of practice through to Level 4 which fully encompasses the working definition of full scope optometry.

The UK is the first country of the EU and member of the EAOO that has reached level 4 of the WCO. Whilst the UK remains some way away from an at-registration level of competence the number of experienced qualified optometrist Independent Prescribers joining the specialist register has now reached 150 and has just about doubled each year since legislation was enacted in 2009.

At the EAOO Prague meeting in 2011 I presented a political/clinical history of the development of therapeutic legislation over 14 years. In October 2010 I enrolled in the joint Aston-Manchester University Independent Prescribing course, which I completed in just over one year in December 2011.

This presentation will describe the essential components needed in a stepwise manner to achieve IP status, from initial application and consideration of prior experience, to didactic taught modules, clinical competency, placement, log book preparation and examination. Data will be presented describing the nature of the clinical placement that covered 162 patients seen over 24 sessions in a busy provincial ophthalmology casualty department. The subtle distinction between patients observed and patients examined will be discussed as part of the learning plan. The breakdown of patients and conditions attending hospital ophthalmology casualty is discussed in the context of those conditions that could be managed by a non-IP qualified optometrist and an IP qualified optometrist along with those who would clearly require medical input.

In conclusion, the presentation will review the cost both in time and money and also review both the opportunistic advantages and return on investment from establishing a prescribing practice.

## Biosafety of hydrogen peroxide solution to disinfect blue light-filtering contact lens

**Lead Author:** Celia Sánchez-Ramos<sup>1</sup>

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### Purpose:

To establish the biocompatibility of hydrophilic lenses made of different materials, each having different absorbance levels for short wavelengths, and treated by peroxide disinfection Ever Clean® (Avizor) on in-vitro human conjunctive fibroblasts.

### Methods:

Human conjunctive fibroblast cultures were incubated for 12 hours in three groups of blue light-filtering contact lens made by different materials (Hema 38%, Profilcon A 52% WC and Ocuflcon D 55% WC) that had been treated by peroxide disinfection Ever Clean®. Toxicity was examined by means of: 1) level of reactive oxygen species, 2) integrity of the mitochondrial membrane, 3) activation of caspase-3 and 4) activation of H2AX, compared with non-treated cells (basal control) and cells exposed to a known cytotoxic effect with H2O2 (toxicity control).

### Results/Data:

The means obtained were normalized in fluorescence units (FU). Means for intensities of reactive oxygen species were as described in Table 1.

**Table 1:**

	Mean			
	Intensities of reactive oxygen species	Mitochondrial membrane potential	Intensities in levels of caspase-3 activation	Intensities in levels of H2AX activation
<b>Hema lenses</b>	0.9886 ± 0.1999FU	1.2863 ± 0.1034FU	1.1442 ± 0.0224FU	1.2014 ± 0.1290FU
<b>Profilcon A lenses</b>	0.8574 ± 0.1632FU	1.1424 ± 0.0826FU	1.0530 ± 0.0300FU	1.1650 ± 0.0964FU
<b>Ocuflcon D lenses</b>	0.9694 ± 0.2022FU	1.2329 ± 0.1049FU	1.0426 ± 0.0580FU	1.3009 ± 0.1585FU
<b>Basal control</b>	1.0000 ± 0.0977FU	1.0000 ± 0.0100FU	1.0000 ± 0.0300FU	1.0000 ± 0.0690FU
<b>Toxicity control</b>	1.5969 ± 0.0176FU	0.6517 ± 9.1349e-3FU	1.6400 ± 0.0190FU	1.8253 ± 0.0650FU

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**Biosafety of hydrogen peroxide solution to disinfect blue light-filtering contact lens**

Statistically significant differences ( $p > 0,05$ ) were not found between the contact lenses made of different materials and the basal control whereas those differences were found between the contact lenses made of different materials and the toxicity control.

**Conclusions:**

A blue light-filtering contact lens undergoing treatment with the disinfection and maintenance solution Ever Clean® are biocompatible on in-vitro human fibroblasts.

## The development of a reading speed chart in English and Portuguese

**Lead Author:** P.M.Serra<sup>1</sup>

**Co-Authors:** M.J.Cox<sup>1</sup>, C.M.Chisholm<sup>1</sup>, F.M.Ferreira<sup>2</sup>

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<sup>2</sup> University of Beira Interior, Department of Physics, Covilhã, 6200-001, Portugal

### **Purpose:**

Visual acuity (VA) is the most common technique used to assess visual performance. However it relies on individual character discrimination, therefore represents only a part of a common visual task. Reading speed (RS) measurement is a more realistic technique, involving the recognition of sequential characters and posterior integration in a cognitive process. Various reading speed charts exist, usually comprising sentences made of related words. However these have a limited number of versions available that may constrain their usefulness when repeated measurements are required. The aim of this work was to develop a protocol to generate reading speed charts, using the Minnesota Reading Speed Chart (MNRead) characteristics, best using paragraphs made of unrelated words.

### **Methods:**

The study had two arms, one enrolling 11 English (EN) speakers (mean age = 33.6 ± 8.5 y/o [23-52]) and the other enrolling 20 Portuguese (PT) speakers (mean age = 26.6 ± 5.1 y/o [20-35]). Mean spherical correction was -3.01 ± 2.45DS (EN), -1.54 ± 1.03DS (PT). In both cohorts, astigmatism was always below 1.00DC, best corrected VA for distance and near was better than or equal to 0.0LogMAR. The reading tasks were performed under monocular viewing conditions, with best correction mounted in a trial frame. Reading chart print sizes were calibrated for 0.33 m reading distance and the target had a mean luminance of 206 cd.m<sup>-2</sup> (EN) and 106 cd.m<sup>-2</sup> (PT). A series of unrelated words paragraphs (100 EN and 40 PT) were generated using common words from English and Portuguese lexicons. Reading times were measured using voice recording (EN) or a stopwatch (PT). For the English study arm the measurement of both the MNRead and reading time of the generated English paragraphs were repeated in a second session. Selection criteria based on the two session's reading times were applied to the 100 paragraphs and criteria designed to remove outliers were applied. Subsequently two versions of the new reading chart were constructed. Participants' reading performance using the new charts was later assessed in two separate sessions. For the Portuguese study arm, paragraph selection from the initial 40 paragraphs relied on criteria applied to one single session. In two later sessions reading performance of the Portuguese cohort was evaluated using a version of the Portuguese MNRead chart and one version of the new reading chart. The MNread charts and the developed charts comprised VA ranging from 1.2 to -0.3 logMAR. Reading performance was analysed in terms of the area under the curve (AUC), threshold print size (TPS), maximum reading speed (MRS) and reading acuity (RA).



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## **The development of a reading speed chart in English and Portuguese**

### **Results:**

Average reading rates measured with the 100 (EN) and 40 paragraphs (PT) were  $198.60 \pm 7.09$  wpm and  $126.83 \pm 4.63$  wpm, respectively. MRS and AUC also showed that reading speed was lower in the Portuguese cohort, whichever chart was used. Reading acuity did not show any difference between the cohorts and the TPS tended to be approximately 0.1 logMAR units higher for the English cohort. In both cohorts MRS decreased when reading performance was evaluated with the developed chart compared with the MNRead one. None of the remaining three parameters (AUC, TPS and RA) showed significant differences between the MNRead versus the developed chart types. Analysis of inter-session repeatability indicates similar levels of repeatability for both charts, on the four parameters analysed.

### **Conclusions:**

Reading speed measured using the type of charts presented here allows for the characterisation of the reading performance, like the one measured with MNRead chart, although with slower reading rates. Creating this type of tool allows for RS evaluation when repeated measurements are present and minimises the influence of cognitive factors present in charts made of related words. Specification of time measuring technique is fundamental for RS comparison between studies.

## Evaluation of ophthalmic technicians, refraction service providers in Mozambique

**Lead Author:** Kajal Shah

**Co-Author:** James Loughman

Dublin Institute of Technology (DIT), Dublin, Ireland

### **Purpose:**

Approximately 314 million people worldwide live with low vision and blindness. 145 million people's low vision is due to uncorrected refractive errors. One of the solutions to creating sustainable eye care structures is education of personnel.

The Dublin Institute of Technology (DIT) with ICEE (International Centre of Eyecare Education) is developing and implementing a sustainable model for optometric education and eye care service delivery in Unilurio in Mozambique. The Mozambique Eyecare Project aims to train Mozambique's first professional optometrists, who will provide a sustainable and comprehensive eyecare system as an integral part of the national health system.

Mozambique currently has only 17 ophthalmologists for a population of 21 million and 34 trained ophthalmic technicians (OCO), the only two providers of refraction services within the local health system.

The purpose of this research is to evaluate the confidence levels, knowledge and core competencies of the ophthalmic technicians in refraction to provide a better understanding of the existing situation.

### **Method:**

Firstly, a background questionnaire was used to obtain data on their years of experience and the training they had received. Secondly, investigative tools were used, including a confidence levels questionnaire, oral refraction quiz and a refraction competency assessment.

### **Results:**

The OCOs were trained in 3 different institutions, in Cuba, Mozambique and Malawi. The Cuban trained OCOs had studied refraction to different levels but due to lack of equipment had never practised basic retinoscopy or subjective refraction for astigmatism. They were not competent in performing refractions unsupervised. The ones trained in Mozambique and Malawi had not studied refraction hence were not competent in performing refractions at all.

### **Conclusion:**

By identifying strengths and weaknesses of the OCO's refraction knowledge and skills, training and continuing education can be tailored accordingly. This information would also allow ICEE and DIT to compare and contrast refraction training for both the student optometrists and the existing OCOs to improve overall refraction service provision in Mozambique.

# Evaluation of student optometrists in Mozambique

**Lead Author:** Kajal Shah

**Co-Author:** James Loughman

Dublin Institute of Technology (DIT), Dublin, Ireland

## **Purpose:**

One of the solutions to creating sustainable eye care structures is education of personnel. Mozambique currently has only 17 ophthalmologists for a population of 21 million and 34 trained Ophthalmic Technicians, the only two providers of refraction services within the local health system. There are no optometrists and DIT, the University of Ulster and the International Centre for Eye care Education (ICEE) are funding a project to train the country's first optometrists at the University of Lurio in Nampula (Unilurio), Mozambique. This is a four year program with the first students graduating as optometrists in November 2012. Their core competencies will be evaluated with a view to creating best practise in education in a developing world environment.

## **Method:**

This is a longitudinal evaluation of the refraction competencies of the first intake of 16 students. Data was compiled from questionnaires, interviews and exam results in the first two years and clinical patient exams in the third year.

**Stage 1:** 16 students in their second year were presented with a questionnaire developed and reviewed by the UKZN/ DIT/ ICEE in August 2010. The questionnaire consisted of 33 5-point Likert scale plus three open ended response questions. There was a general overview question and five student related questions. There were questions based on student details, module, lecturer, resources and assessment, practicals linked to the theory and tutorials linked to the theory module. The module evaluated was Introduction to Optometry, which was delivered by a Spanish lecturer with notes in English to students whose first language is Portuguese.

**Stage 2:** The final score was the average of the continuous assessment and the final exam. If a student failed they could carry the subject into the next year of the programme and repeat.

**Stage 3:** All 16 students were interviewed personally about their educational background on Wednesday 15/09/10. Five students from the year group were interviewed for an hour on Friday 17/09/10 with a Portuguese translator to gain more insight into the results of the questionnaire (Stage 1). Four were male and one female, with two from Nampula, one from Zambezi, one from Cabo Delgado and one from Maputo.

**Stage 4:** Clinical patient exams in the third year: 11 students who had progressed to their third year were observed as they carried out refractions on a patient on 25/10/11. Students' clinical competencies in case history, VA measurements, retinoscopy, subjective testing, near refraction, prescribing spectacles and referral were assessed.

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### **Evaluation of student optometrists in Mozambique**

#### **Recommendations:**

Language of instruction and course material would be better suited to students in the local language (Portuguese) as both students and lecturers find them difficult to interpret in English. However, the students have to be encouraged to learn English as the 'worldwide' language of optometry.

The students had no concept of optometry when the Introduction to Optometry module was delivered to them. The optometric terminology was foreign to them. As a result, the notes have to be adapted to a developing world context where few students if any have ever been to an optometrist and none of them had an idea what the course/profession entails.

Publicising the course within the university and local communities would raise awareness of what optometry is about. Delivery of practical lessons and availability of resources (space for a laboratory and equipment) to support these sessions requires attention. A fixed room with projector and good lighting is required. Optometry books in Portuguese in the library and improved access to them, as well as improved IT access, are also important.

In terms of refraction skills, all the 11 students in their third year were proficient at history taking, measuring VA, near refraction, prescribing spectacles and referral. Five students would have benefitted from more tutorials on retinoscopy and subjective testing. None of the students were proficient with binocular balancing and +1.00 blur test.

#### **Conclusion:**

Overall the ratings of the semester were generally positive. Language of delivery, availability of resources and assessments appear to be the three main areas of concern. Progress has already been made in the following areas:

- lecture notes have been translated into Portuguese
- the course coordinator has spoken with the English lecturer to introduce optometry terminology to the students
- 15 optometry books were donated by DIT for the course
- a room has been allocated as clinic/lab space until the actual new clinic has been constructed
- the clinics are now fully equipped with relevant equipment including ophthalmoscopes, retinoscopes and trial lens sets
- PCs for all the lecturers and a projector for them to share have been sourced

Evaluations on their clinical skills will assist the course coordinators to improve the course as the student's progress through it. Continuous quality control of student learning and experience is of value both to the course funders and the university implementing the course.

Finally, lessons learnt here in the design of questionnaires and analysis of data augurs well for implementation in other schools of optometry. It is wished that the lessons learnt from this investigation will be used by partners, module coordinators and lecturers to improve areas raised by students.

# Power calculation and customized designs for intraocular lenses using personalized eye models

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## **Purpose:**

Approximately 20 million cataract operations are performed per year worldwide, routinely removing the cataractous lens and implanting an Intraocular Lens (IOL). Modern technologies used to treat cataract are highly sophisticated and the operation involves remarkable skills. However, the power calculation in certain circumstances can be unsatisfactory. Currently the calculation of required IOL power is based on formulas developed from geometrical optics step-vergence equations and/or statistical analysis of retrospective cases. This work aims to improve upon the methodologies currently used to predict IOL power, particularly in cases of extreme ocular biometry. It also demonstrates the usefulness of personalised eye models in investigations of IOL designs proposed to correct the higher order aberrations of the eye.

## **Methods:**

Biometric data was collected on a cohort of subjects undergoing routine cataract surgery with phacoemulsification and in-the-bag implantation with Akreos Adapt AO™ (Bausch and Lomb) IOL. Anterior corneal topography elevation data (Atlas 9000™, Carl Zeiss Meditec) and segmented axial length data using optical low coherence reflectometry (Lenstar 900™ Haag-Streit) was collected on both eyes of each subject prior to surgery. The same measurements were repeated approximately three weeks post-operatively with additional measurement of aberrometry (ZyWave™ Bausch and Lomb) and autorefractometry (ARK-510A™ Nidek) to quantify the refractive outcome.

## **Results /Data:**

Using carefully measured biometry, personalised eye models were generated and their accuracy in predicting the required IOL power was compared to standard industry formulas applied to the same sample of eyes. The personalised models were also used to study the optimal customised IOL design for each individual eye. Simulation of higher order aberration correction allows the retinal image quality to be quantified, which is a preliminary step in investigating the potential visual benefit from customised aberration-correcting IOL designs.

## **Conclusions:**

Refractive outcomes of cataract patients may be improved by establishing a comprehensive methodology regarding IOL power, design and selection process. Personalised ray tracing eye models are an important tool in this regard and reduce reliance on approximations inherent in the current industry standard formulas.

## Creation of a pilot scheme to raise awareness of optometry & optics as career options for 14-16 year-olds

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**Co-Authors:** Ellen Colquhoun<sup>2</sup>, Leah Newby<sup>3</sup>, David Thomson<sup>4</sup>

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### **Background:**

An increase in the number of training places and a decrease in the overall number of applicants has made it more difficult to recruit good quality students to optometry degree programmes in the UK which impacts universities, employers and ultimately the profession. There is a need to raise awareness of optometry and optics as career choices so that we can recruit bright, well-motivated students to enhance career engagement and create a future-proof profession.

### **Aim:**

This scheme aimed to raise awareness of optics as a career choice in schools and sixth form colleges, influence post-16 options and positions optometry and optics as desirable career choices, improving the calibre of applications to universities and targets specific regions where recruitment challenges exist.

### **Method:**

In April 2010 a small group representing professional associations, universities and employers met who initiated a challenge to the profession as a whole and a request for support. Subsequently a 17-member cross-profession working group was formed which developed the Careers in Optics initiative in partnership with input from education marketing specialists. A curriculum linked programme for 14-16 year olds was piloted in seven schools and reached over 300 students.

### **Results:**

Pre-intervention feedback showed that 73% of students had considered their future career but the most common response when asked to give three words associated with optometry and optics was 'I don't know'. Post-intervention 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, seven weeks after the event, the difference between an optometrist and a dispensing optician.

### **Conclusion:**

This programme has shown that the profession can work successfully together across academic, commercial and trade boundaries to create a national programme to promote careers in optics that will ultimately benefit the profession and improve the nation's eye care provision.



## Evaluation of a pilot scheme in Uganda to support the national primary school vision screening programme with additional refraction services

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### **Background:**

The Ugandan Ministry of Health identified a need to provide further eye care for a group of primary school students previously vision screened as part of a national initiative to promote inclusive education. Due to a short-term shortage of manpower and resources this could not be implemented. The Ministry approached Sightsavers who in turn contacted Vision Aid Overseas to provide this follow-up eye care in Western Uganda.

### **Purpose:**

This pilot scheme aimed to evaluate the effectiveness of using a Vision Aid Overseas team to provide follow-up refraction services for a national vision screening programme, to supplement local refractionists and to provide eye care for a group of children identified to have vision problems.

### **Methods:**

Itinerant special needs teachers and individual schools in two education districts were contacted one month before the planned refraction clinics and tasked to vision screen all their pupils. They compiled a list of students with vision or eye health problems to be seen at the subsequent refraction clinic.

### **Results:**

562 children under 16 years-old were examined. 35% were found to have an uncorrected refractive error of which 69% were hypermetropic and 31% myopic. Of the 40 students (7% of total patients) presenting with symptoms, 17 (3% of total patients) were referred. 118 pairs of spectacles were dispensed.

### **Discussion:**

Where vision screening was undertaken by the relevant teacher prior to the arrival of the VAO team, and lists of identified children were available, the team could provide targeted eye care, ophthalmic referral and spectacles, reducing the percentage of clinic time spent testing children with normal vision and healthy eyes.

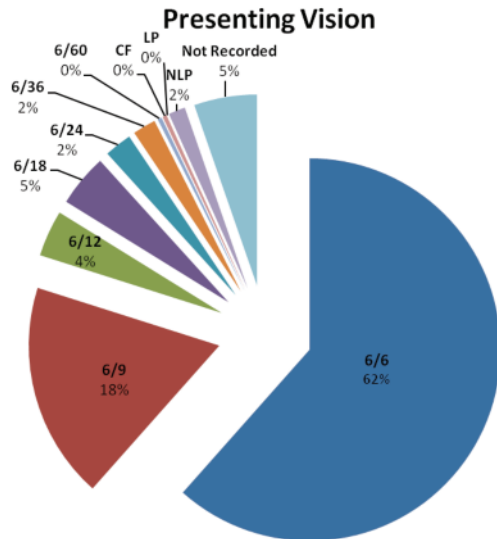


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### Evaluation of a pilot scheme in Uganda to support the national primary school vision screening programme with additional refraction services

#### Recommendations:

The format of supporting existing government (Ministry of Education/Ministry of Health) primary school vision screening programmes in an integrated manner to enhance the country's own national programme and boost the numbers of children reached, whilst supporting local healthcare workers and teachers, is effective. It demonstrates measurable outcomes and immediate health and educational gains.



## Does an optometric investigation help to diagnose neuropathy?

**Lead Author:** Robert Szuba

**Co-Author:** Piotr Tomczak

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### **Summary:**

The present optometric investigation of binocular vision points to some disorders of visual system in diabetic patients. These disorders may indicate early changes in nervous system.

### **Introduction:**

Vision is compromised by the neuropathy caused by diabetes mellitus. To characterise this, accommodation, phoria and vergence amplitudes were measured in diabetic patients. The obtained values were compared with those measured for healthy persons.

### **Results:**

The accommodation of diabetic patients was reduced as compared to healthy persons. Significant differences were observed also in the exophoria at near distance. Additionally, the values of vergence amplitude and the ability of phoria compensation were statistically significantly different in both groups.

### **Conclusions:**

As far as measured parameters are concerned, diabetes influences the visual system. The investigation of binocular vision may be used to prognose and evaluate, neuropathic changes. The activity of the nervous system may be burdened with diabetes mellitus. The results of investigation of binocular vision may be used to prognose and monitor possible neuropathic changes.

# Binocular accommodative facility in pre-presbyopic Swedish adults

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**Co-Author:** Eleonor Tjerngren

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## **Purpose:**

The purpose of this study was to investigate the prevalence of binocular accommodative infacility in pre-presbyopic Swedish adults and to compare the facility rates between  $\pm 2.00$  D and  $\pm 1.00$  D flippers within this age group. The study also investigated whether there was any correlation between binocular facility rates and amplitude of accommodation, positive and negative relative accommodation and amount of near work.

## **Methods:**

50 subjects aged between 30 and 42 years living in and around Stockholm city in Sweden were recruited. All the subjects had an amplitude of accommodation  $\geq 5.00$  D and normal Stereopsis. Accommodative facility was measured binocularly at 40 cm with  $\pm 2.00$  D and  $\pm 1.00$  D flippers. The number of cycles cleared during one minute period (cycles per minute- cpm) was documented with both the flippers. The subjects also completed a questionnaire providing information about the number of hours of near work performed in a week.

## **Results:**

A paired samples t-test showed a significant difference between the mean facility rate of  $\pm 2.00$  D and  $\pm 1.00$  D flippers ( $p < 0.001$ ). The mean binocular accommodative facility with  $\pm 2.00$  D flippers was  $5.65 \pm 4.05$  cpm and with  $\pm 1.00$  D flippers was  $15.98 \pm 4.53$  cpm. The prevalence of accommodative infacility with  $\pm 2.00$  D flippers (less than one standard deviation below mean, 0 to 1.5 cpm in this sample) was 22%. The regression analysis showed a significant correlation between amplitude of accommodation and facility ( $p < 0.05$ ,  $r = 0.29$ ). There was a significant difference in positive relative accommodation between the infacility group and the normal group. There was no significant correlation between the amount of near work per week and accommodative facility ( $p > 0.05$ ,  $r = 0.03$ ).

## **Conclusions:**

The prevalence of accommodative infacility (22%) in this sample was slightly higher than previous published studies. The mean facility rate with  $\pm 2.00$  D flippers was lower than previously published normative data for adults despite all the subjects having good amplitude of accommodation.

# A cost benefit analysis of an optometric higher education programme in Mozambique

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## **Purpose:**

To evaluate whether a higher education optometric programme in Mozambique can be economically justified in terms of reducing the loss of productivity associated with uncorrected refractive error at a national level. Simply, this study aims to demonstrate whether the economic benefits of implementing such a project outweigh the costs in monetary terms.

## **Methods:**

Standard Cost Benefit Analysis methodology will be applied, comparing the cost of an intervention (in this case the implementation of a optometry course within a higher education institution) and the benefit that intervention brings (correcting refractive error). The benefits of the project were calculated in terms of saved productivity achieved through correcting refractive error. The costs comprised all direct and indirect costs incurred from the project's inception to the point when the VISION 2020 target for human resources is met and the population could in theory avail of a full and comprehensive optometric service. In reality there would be most likely be a challenge to provide a service to those living in rural areas, but for the sake of this analysis challenges around urban/rural service access have not been included.

## **Results / data:**

Using existing burden of uncorrected refractive error methodology, the cost to Mozambique was conservatively estimated to be \$14.5 million per annum in terms of lost productivity. This estimate also takes into account the productivity lost due to a relative, friend or neighbour providing care for a blind or visually impaired person. Also, the estimate is conservative as it does not include people suffering from presbyopia and assumes those over 50 years old do not contribute to the national economy.

At the time of writing the data on costs of the programme was still being analysed. Costs will be divided into direct and indirect, using methodology pioneered by Rice on her work on cost of illness. The establishment costs will be added to the costs per annum, and then will be compared to the net present value of the programme over a period of years, taking into account an appropriate discount rate.

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### **A cost benefit analysis of an optometric higher education programme in Mozambique**

#### **Conclusions:**

Education and human resource development has long been championed as a sustainable way of reducing blindness and visual impairment. By building local capacity through training projects, the economic impact of refractive error and other eye conditions on a population can be reduced.

Similar research in the Gambia showed that although the costs of establishing such a programme were high, these were outweighed by the value of improved productivity of beneficiaries during their working lives. Economic analysis in India has also illustrated high rates on return for investment to reduce blindness and visual impairment.

## Molecular genetics of retinitis pigmentosa: understanding the foundations of some retinal degenerative diseases

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The new profile of a European optometrist should include the ability to detect eye diseases and to be able to immediately refer patients to an ophthalmologist upon detection of any suspicious symptom. In this sense, many European curricula include notions of ocular pathology, based on a prior understanding of ocular physiology and visual processing. Within the latter, we can locate the development of a subject such as the neurobiology of vision that includes a comprehensive development of the phenomenon of visual phototransduction. If the optometrist gets deep insights into this process, he/she will be ready for a better understanding of many retinal degenerative diseases, including retinitis pigmentosa, which is an important example because of its prevalence in the world.

The term retinitis pigmentosa (RP) describes a broad group of hereditary retinopathies, which appears very heterogeneous both from a genetic as well as a clinical standpoint. RP is currently the leading genetic cause of blindness in adults and it has no cure to date. It has a prevalence of about 1.5 million people worldwide and its incidence is approximately 1 per 4000. The first symptom of RP is night blindness, and at a more advanced stage, progressive loss of peripheral vision due to rod cell degeneration.

Rhodopsin, the visual pigment of the rod cells, is a specialized protein capable of acting as a photoreceptor. It consists of a protein portion, and a chromophoric unit, the 11-cis-retinal. Its archetypical helical structure was determined as containing 7  $\alpha$ -helices and a primary sequence comprising 348 amino acids (Figure 1).

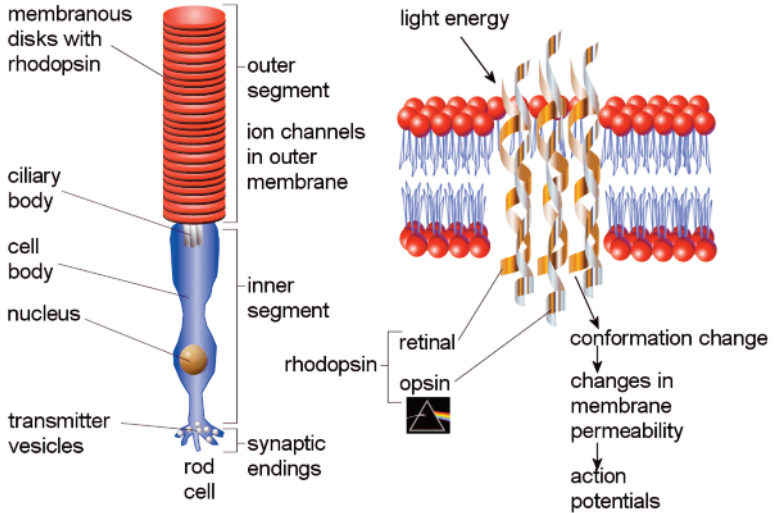
In 1990, the first mutation in a gene expressing rhodopsin in RP patients was discovered, the P23H mutation, which involves a proline to histidine change. In the past two decades many other mutations have been found in rhodopsin (Figure 2) and in other genes that encode for other proteins of the visual phototransduction cascade.

This disease results in significant visual impairment that can be ameliorated with optical devices that contribute to a better performance and for this the practitioner of optometry needs a detailed knowledge of the visual process.

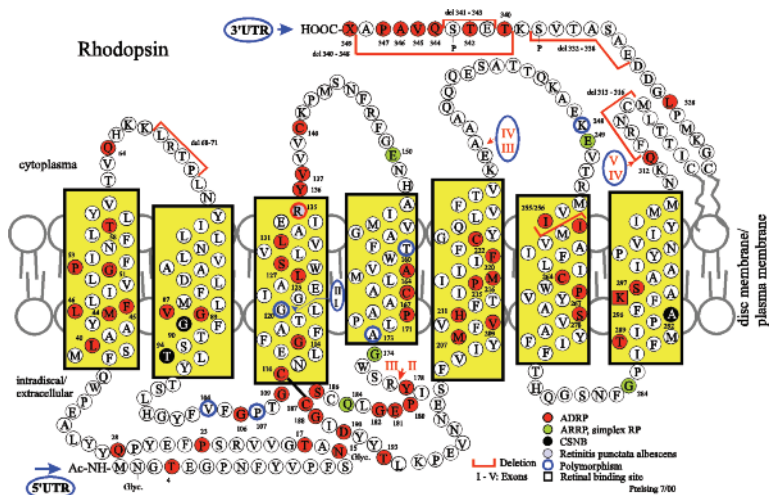
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## Molecular genetics of retinitis pigmentosa: understanding the foundations of some retinal degenerative diseases

**Fig 1:** Location of rhodopsin in rod outer segments (left) and helical structure (right).



**Fig 2:** Location of mutations associated with RP in rhodopsin.



## Faculty recruitment for a Portuguese-language optometry programme: experiences and challenges of the Mozambique eye care project

**Lead Author:** Diane Wallace

University of KwaZulu Natal, South Africa

### **Purpose:**

The Mozambique Eyecare Project (MEP) is a unique institutional collaboration in a programme for the development, implementation and evaluation of a regional optometry training model for Portuguese-speaking Africa. The project was initiated in February 2009 with the first cohort of undergraduate students beginning classes at Lúrio University in Northern Mozambique. This is the first Portuguese-language optometry program in Africa, and with no professionally qualified optometrists locally, faculty had to be recruited from outside the continent. To date, nine optometrists, either Portuguese or Spanish speaking, were recruited from Spain, Portugal and Colombia. This paper will present data related to recruitment of faculty, their interest in joining the Project, experiences and challenges on the Project as well as benefits gained from the experience.

### **Methods:**

Semi-structured interviews were conducted with five expatriate faculties who spent time on the project between May 2010 and October 2011. Data from all nine faculty was qualitatively analysed for common themes around faculty experiences on the project.

### **Results:**

Faculty were recruited through professional networks, website postings or word-of-mouth. Five of the nine faculty were Spanish-natives, two Colombian with Spanish as a first language, and two were Portuguese nationals. Only three of the nine faculty had prior university teaching experience, with eight of the nine having post-graduate qualifications. Of these, five were Masters qualified and three had PhD qualifications. Recruits signed either a one year renewable contract or offered short-term availability of one to three months. Only one recruit has extended the one year contract with the majority of stays being three months or less. Experience on the project was described as professionally stimulating and rewarding. The difference in scope of practice, skills and regulation of optometry in the countries represented by faculty presented some challenges in delivering a unified curriculum approach which may be different to one's own training or experience. Locally, bureaucratic structures and difficulties with transportation were some of the frustrations experienced.

### **Conclusions:**

As optometry is still a developing profession in Portugal, it is difficult to find Portuguese-language optometrists with university teaching experience who are available for long term contributions to such challenging assignments. All faculty noted, however, the personal satisfaction and sense of contribution from working on the project, despite the challenges. Those who had never worked in academia or development before, also acquired a new skills set they could carry into their future careers.



# Epidemiology of refractive errors among the elderly in Sari, Iran

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## **Purpose:**

To determine the prevalence of refractive errors and their determinants among the elderly in Sari, in the north of Iran.

## **Methods:**

Random clustering sampling was used to determine the elderly aged 55 or over for a population-based study. All participants underwent complete eye examinations including objective and subjective refractions, actual and optimal visual acuities, biomicroscopy, funduscopy, tonometry and visual field testing. Myopia and hyperopia were defined as spherical equivalent (SE) < -0.50 diopters (D) and >+0.50 D respectively. Astigmatism was defined as a cylindrical power worse than -0.50D. Anisometropia was defined as different in SE between two eyes >1.0.

## **Results:**

Of the 1185 selected participants, 79.1% participated in the study. The mean age of the subjects was 64.7 (range 55-87) years and 53.6% of them were females. According to the age and sex standardised, the prevalence of myopia, hyperopia, astigmatism and anisometropia were 19.7% (95% confidence interval [CI], 17-22.4), 39.5% (95% CI, 36.1-42.9), 23.6% (95% CI, 20.7-26.4) and 7.8% (95% CI, 6.0-9.6). The prevalence of at least one type of ametropia (myopia, hyperopia or astigmatism) was 64% (95%CI, 60.7-67.3). The prevalence of myopia was greater in males and increased with cataract and decreased with increasing age. Astigmatism was more in cataract, decreased with increasing age and was not associated with sex. The prevalence of anisometropia was more in subjects with cataract ( $P<0.001$ ) and was not correlated with age or sex.

## **Conclusions:**

This study indicated that the prevalence of at least one type of ametropia is relatively high in the elderly and one of the most important factors is cataract.



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