

Academy of Vision Care™

Welcome to Bausch and Lomb's monthly research update.

With our background in clinical ophthalmic research, mainly of the anterior eye, Bausch and Lomb have asked us to produce an independent report of some of the interesting findings coming out of the research journals each month. As a busy practitioner, this should allow you to keep more up-to-date with cutting edge clinical research and allow you to locate the articles when you want to know more about a topic highlighted.



Professor James Wolffsohn is Professor of Optometry, Deputy Dean of Life and Health Sciences at Aston University. James' research and teaching interests mainly revolve around intraocular lenses, contact lenses, low vision and the measurement of accommodation. He has published over 100 peer reviewed academic papers, written books on Low Vision and Imaging and has given numerous international presentations. James is also a past President of the British Contact Lens Association.



After graduating with a 1st-class B.Sc. (Hons) degree in Optometry from UMIST in 2004, Amit successfully completed the College of Optometrist's professional qualification examinations in 2005. Amit has worked as an Optometrist in several clinical capacities, including within the field of corneal refractive surgery. He has recently completed a Ph.D. at the University of Manchester researching optical quality in patients with Keratoconus. He is currently working with Prof. Wolffsohn in a post-doc position at Aston University.

Issue 20

The following key clinical peer reviewed journals will be reviewed:

JOURNAL	VOLUME
American Journal of Ophthalmology	152(5)
Archives of Ophthalmology	129(11)
British Journal of Ophthalmology	95(11)
Clinical and Experimental Ophthalmology	39(8)
Cornea	30(12)
Investigative Ophthalmology and Visual Science	52(12)
Journal of Cataract and Refractive Surgery	37(11)
Journal of Refractive Surgery	27(11)
Ophthalmic and Physiological Optics	31(6)
Optometry and Vision Science	88(11)

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Visual function with zonal refractive aspheric multifocal intraocular lenses

Munoz *et al.* evaluated the visual performance of Lentis Mplus (model LS-312MF; Oculentis GmbH) multifocal intraocular lenses (IOLs) implanted bilaterally in 64 eyes of 32 patients. In addition to distance, intermediate and near visual acuities, the authors also investigated post-operative refraction, sine-wave contrast sensitivity and defocus curves. A quality of vision questionnaire was also administered to quantify the presence of photic phenomena, spectacle independence and overall satisfaction. The Mplus multifocal lenses provided adequate logMAR distance (-0.04 ± 0.07 - at 6 m), intermediate ($+0.14 \pm 0.08$ - at 1 m) and near visual acuities ($+0.07$ ffl 0.07 - at 40 cm). However, the defocus curves showed a slight reduction in intermediate vision between 0.40 m and 1.00 m. Equally, photopic contrast sensitivity for near vision and mesopic contrast sensitivity for distance vision, with or without a glare source, was found to be reduced at spatial frequencies of 12 and 18 cycles/degree. Nonetheless, around 85% of patients were found to be completely independent of spectacles and less than 13% of patients reported haloes or glare, indicating that Lentis Mplus multifocal lenses can provide a useful option for vision correction in patients with cataracts.

Journal of Cataract and Refractive Surgery 2011 37 2043-2052

Containing an outbreak of diffuse lamellar keratitis (DLK)

Although previous reports have described different experiences in the context of DLK outbreaks, the inconsistency in the literature makes it difficult to establish appropriate strategies for initiating a scientific approach to resolving the problem at the start of an outbreak. Javaloy *et al.* report their methodology to identify the incidence and etiological factors, in addition to the investigations carried out to isolate the cause and strategies carried out to prevent the occurrence of new cases. In this study a team of epidemiologists were invited to explore 202 cases of DLK over a total of 783 surgical procedures (within a 5-month period) to evaluate all possible faults associated with the surgeries, as the actions taken by the surgical team to stop the outbreak had little effect. The results showed that contracting an external team of professional epidemiologists to evaluate the situation and employ a progressive strategy, which covered all aspects of the surgical procedure, substantially reduced the incidence of DLK, even though the exact cause of the outbreak was not determined.

Journal of Refractive Surgery 2011 27 796-803

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Accommodation responses with multifocal contact lenses

Most multifocal contact lenses are designed to provide simultaneous focus, i.e. where the lens provides images on the retina that are set for distance and near vision at the same time, to provide both distance and near vision in presbyopic patients. This pilot study explored whether 3 'centre-near' design multifocal contact lenses provided images from near objects clear enough to provide a reduction in the accommodative responses of 10 young subjects (average age 29 +/- 3 [SD] years). Accommodation responses and pupil diameters were measured with each of the 3 multifocal lenses, and a control single vision lens, using a commercially available Hartmann-Shack aberrometer. The results indicated that the 3 multifocal contact lens designs evaluated did not induce large changes in the accommodative system compared with the single vision lens.

[Optometry and Vision Science 2011 88 1309-1316](#)

1-year refractive results using the Allegretto wave eye-Q excimer laser

Gambato *et al.* evaluated the wavefront-optimised Allegretto wave eye-Q excimer laser platform. Three hundred and three patients' surgical results (303 eyes) were analysed up to 1 year after surgery. The safety, efficacy and refractive predictability of this surface ablation procedure was evaluated for up to 12 months after surgery. The results show that at 12 months, the mean uncorrected distance logMAR visual acuity was 0.01 +/- 0.05 log units (range +0.30 to -0.04 log units), where 95 % of eyes achieved uncorrected distance visual acuities either equal to or better than their pre-operative corrected distance visual acuity ($p < 0.001$). The mean post-operative manifest refraction spherical equivalent (MRSE) was -0.03 +/- 0.15 D (range -0.75 to +0.75 D), with 99 % of eyes achieving a MRSE within ffl 0.50 D. The authors concluded that advanced wavefront-optimised corneal surface ablation using the Allegretto wave eye-Q platform provides predictable refractive outcomes.

[Journal of Refractive Surgery 2011 27 792-795](#)

Contact lens case contamination in refractive surgery candidates

Kratz *et al.* incubated fluid samples from the contact lens cases of 16 refractive surgery patients. Using a 'broth-based' culture the authors found that 61.5 % (16 out of 26) of the compartments tested were contaminated with at least one form of infective microorganism. Of the 16 positive cultures, 15 cultures grew bacteria. Four of the 16 positive cultures had more than one pathogen identified in one storage case. In two of the 16 positive cultures, simultaneous growth of four or more pathogens was seen in the same storage case. The most commonly identified pathogen was *Pseudomonas* (including *Pseudomonas aeruginosa*), which accounted for about one-third of positive cultures. The high rates of contamination of contact lens storage cases in this cohort of refractive surgery candidates, demonstrated in this report, may put such patients at higher risk of developing postoperative infections compared to non-contact lens wearing candidates.

[Journal of Refractive Surgery 2011 27 811-817](#)



The efficacy of riboflavin/UVA corneal cross-linking in halting the progression of keratoconus

Twenty-two patients with recent keratoconus progression were investigated in this randomised, prospective study by O'Brart and colleagues. Following epithelial removal, one eye was treated with collagen cross-linking (CXL) using riboflavin and UVA irradiation, whereas the fellow eye was left untreated to act as a control. A follow-up examination was conducted eighteen months after treatment. The authors reported that in the treated eyes best-corrected visual acuity significantly improved, along with a reduction in simulated keratometry, cone apex power, root-mean-square error, coma, spherical aberration, secondary astigmatism and pentafoil from baseline. The authors concluded that corneal collagen cross-linking appears to be an effective modality to halt the progression of keratoconus.

[British Journal of Ophthalmology 2011 95 1519-1524](#)

Mathematics of Zernike polynomials

The optical properties of the eye may be evaluated using an assortment of different methods including ocular aberrometry. Such measurements have gained an increasing popularity across the fields of both ophthalmology and optometry. Zernike polynomials are classically used as the fitting method to describe the complex wavefront shapes captured through aberrometry. A number of key clinical applications utilise Zernike polynomials, including the investigation of corneal disease and imaging the retinal micro-structural using adaptive optics. In this report, McAlinden, McCartney and Moore present a review of the mathematical concepts behind Nobel prize-winner Fritz Zernike's polynomial terms and their current applications within the field of optics.

[Clinical and Experimental Ophthalmology 2011 39 820-827](#)

Simultaneous topography-guided PRK followed by corneal cross-linking

Kymionis *et al.* evaluated the long-term follow-up results of simultaneous topography-guided PRK followed by corneal collagen cross-linking (CXL) in 31 eyes of 26 patients previously diagnosed with progressive keratoconus. The data presented in this report were collected up to an average of 20 +/- 4 months [SD] after treatment. The results showed that the mean spherical equivalent and mean steep and flat keratometry readings were significantly reduced compared to baseline. Equally, the authors found that both uncorrected and best-corrected logMAR visual acuities were significantly better at the final visit than at baseline. This study demonstrates that simultaneous topography-guided PRK followed by CXL may be a useful treatment alternative for patients with progressive keratoconus.

[American Journal of Ophthalmology 2011 152 748-755](#)

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Validation of an on-line referral guide for melanocytic fundus lesions

Important clinical decisions must be made regarding the appearance of melanocytic fundus lesions, such as the likely diagnosis and whether to monitor, or to refer for a second opinion. In this report, Hemmerdinger et al. evaluated the validity of an on-line referral guide where 52 screening optometrists and an ophthalmologist, specialising in ocular oncology, both graded a series of fundus pictures. The results showed substantial agreement between this cohort of optometrists and the ophthalmologist in the planned management of melanocytic retinal lesions. Agreement on specific tumour features varied from fair (tumour shape – unweighted Kappa: 0.27) to almost identical (optic nerve head contact – unweighted Kappa: 0.85). The authors concluded that their referral guide enhanced the opportunity for treating patients with suspicious melanocytic fundus lesions whilst potentially reducing the number of unnecessary referrals to the hospital eye services.

[Ophthalmic and Physiological Optics 2011 31 574-579](#)

Correlation between visual field loss and multispectral imaging of the neuroretinal rim (NRR)

In this investigation Denniss and co-workers used multispectral imaging to explore how local wavelength-specific differences in light absorption by the NRR tissue related to visual field (VF) sensitivity losses in patients with (n = 22), or suspected of having (n = 7), primary open-angle glaucoma (POAG). A custom-made digital fundus camera was used to obtain the multispectral images whereas VF data were collected using the Humphery VF analyser (SITA 24-2 program). The results indicated that the spectral absorption properties of the NRR were significantly related to VF losses in this cohort of patients. The authors concluded that multispectral imaging allows a simple, non-invasive method to further assess patients diagnosed with or suspected of having POAG.

[Investigative Ophthalmology and Visual Science 2011 52 8732-8738](#)

The effect of age on amblyopia treatment in children

Recently published evidence suggesting that amblyopia treatment is still effective in some older children raises the age-old question of whether or not there is a relationship between the magnitude of treatment response and age. In this study Holmes et al. performed a meta-analysis of subject data from 4 completed randomised amblyopia treatment trials; each study had similar entry criteria and included a total of 996 subjects. The data presented showed that children between 7 and 12 years of age were significantly less responsive to treatment compared to younger children. Interestingly the data also indicated that there was no significant difference in treatment response for children aged between 3 up to 5 years old and children aged between 5 up to 7 years old. The authors therefore concluded that the magnitude of amblyopia is more likely to be reduced by treatment in children aged less than 7 years old.

[Archives of Ophthalmology 2011 129 1451-1457](#)

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Electrical impedance tests of tear film osmolarity for dry eyes patients

Although tear film hyper-osmolarity has been proven to be a significant diagnostic of dry eye disease, its measurement has often been challenging thereby limiting its clinical application and use. Here, Jacobi and colleagues evaluated a recently developed osmometer, based on electrical impedance which provides quick and accurate measurements of osmolarity using a small volume of tears. The authors report that 133 patients with moderate to severe keratoconjunctivitis sicca (KCS) shows significantly higher tear film osmolarity compared to 95 control subjects, with a specificity of 81 % and a sensitivity of 87 %. In conclusion, tear film osmolarity measurements provided to be an effective, objective diagnostic tool for the diagnosis of dry eye disease.

[*Cornea* 2011 30 1289-1292](#)

Measuring retinal nerve fibre layer (RNFL) thickness using OCT

In this report, Chen *et al.* applied a robust set of statistical analyses to evaluate the correlation between RNFL thickness measurements obtained using spectral-domain OCT and time-domain OCT in a large cohort of Chinese subjects with differing stages of glaucoma. The author's results demonstrated better correlation between the two OCT devices when using a generalised estimating equation (GEE) mixed model method compared with traditional Pearson's correlation methods. Interestingly, the results showed consistently higher RNFL thickness measurements with time-domain OCT method than with spectral-domain OCT. The authors therefore concluded that clinicians should be cautious when interpreting RNFL thickness data for patients undergoing long-term follow-up with different OCT instruments.

[*Optometry and Vision Science* 2011 88 1326-1332](#)

Most intriguing journal paper title this month...

"Optimizing intraocular lens power calculations in eyes with axial lengths above 25.0 mm"

Previous investigations have demonstrated that modern intraocular lens (IOL) calculations give accurate outcomes for eyes with axial length (AL) measurements between 22.0 and 25.0 mm. Here, Wang et al. propose a method of optimising four different IOL power calculation formulas (Holladay 1, Haigis, SRK/T and Hoffer Q) in long eyes to avoid residual postoperative refractive error. The results showed significant correlations between the IOL master ALs and the 'optimised' AL values for each of the four formulas evaluated ($R^2 > 0.96$ with $p < 0.001$). These findings indicate that AL optimisation will reduce the likelihood of unwanted hyperopic defocus after IOL implantation in highly myopic eyes.

[*Journal of Cataract and Refractive Surgery* 2011 37 2018-2027](#)

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Most fascinating research finding of the month...

Numerous studies have shown that anterior segment OCT and in vivo confocal microscopy provides detailed images of the corneal micro-structure. However, Rehnman et al. hypothesised that Scheimpflug images (captured using the OCULUS Pentacam) may allow a useful densitometric evaluation of the cornea to estimate the stromal response after collagen cross-linking (CXL). The author's results demonstrated that Scheimpflug photography can be used to estimate and quantify alterations in corneal light scattering after CXL, and that the increased light scatter found after treatment was not evenly distributed throughout the thickness of the cornea. The report concludes that corneal light scattering provides an impression of tissue changes and the depth of the CXL treatment effect. It is expected that further assessment of this parameter will provide important information about the corneal response to CXL.

[Spatial distribution of corneal light scattering after collagen cross-linking](#)

[Journal of Cataract and Refractive Surgery 2011 37 1939-1944](#)

Next report

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