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.

Welcome to the third Research update of 2013, in which the peer-reviewed journals listed below are reviewed. This month, tear film research reveals that tear film stability and osmolarity are affected by exposure to high levels of air pollution, whilst oral contraceptive use and contact lens wear do not appear to affect tear osmolarity in young women, although this combination may exacerbate dry eye symptoms. In the field of contact lenses, a new study investigates the visual performance of new dual focus lenses designed to retard myopic progression, whilst contact lens fitting is shown to provide visual improvement in scarred and opacified corneas, even in young children. Several interesting intraocular lens studies are published this month, including evaluations of trifocal, accommodating and low-cost options. As usual, the update concludes with the most fascinating research finding of the month and the most intriguing paper title.

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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.

Dr Amy Sheppard is a lecturer in Optometry at Aston University, with responsibility for the department’s professional development courses, including the Doctor of Optometry programme. Following several years in optometric practice, Amy undertook a PhD in the field of human accommodation and ocular imaging, which was awarded in 2010. Amy’s current research is centred around accommodation/presbyopia, intraocular lenses and ultraviolet radiation and contact lenses. Amy is an associate of the UK Higher Education Academy and her teaching responsibilities at Aston include undergraduate primary ophthalmic examination and postgraduate lecturing in the field of ophthalmic examination and accommodation and presbyopia.
Tear Osmolarity and Dry Eye Symptoms in Women Using Oral Contraception and Contact Lenses

Chen and colleagues enrolled 97 young women in their study of the effect of oral contraceptives on tear osmolarity and dry eye symptoms, as assessed by the Ocular Surface Disease Index (OSDI) and Symptom Assessment in Dry Eye (SANDE) questionnaires. Tear osmolarity was not affected by either oral contraceptive use or contact lens wear, although women using both contact lenses and the contraceptive pill reported an increased severity of dry eye symptoms. No differences between the phases of the menstrual cycle were detected.

*Cornea 32: 423-428*

Correlation Between Signs and Symptoms of Ocular Surface Dysfunction and Tear Osmolarity With Ambient Levels of Air Pollution in a Large Metropolitan Area

This novel study, based in São Paulo, Brazil, examined 71 taxi drivers and traffic controllers to investigate the effect of exposure to high levels of air pollution on tear osmolarity and clinical signs/symptoms. Tear break up times were found to be reduced, although vital staining and Schirmer test results were typically within normal limits. Interestingly, few symptoms were reported by participants on the Ocular Surface Disease Index questionnaire, despite high exposure to nitrogen dioxide and particulate matter smaller than 2.5 μm (PM2.5). Increased exposure to PM2.5 was associated with a significant reduction in tear osmolarity. Overall, the study found that exposure to high levels of air pollution reduces tear film stability and affects tear osmolarity.

*Cornea 32: e11-e15*

Ocular Discomfort in Pterygium Patients

Julio and colleagues examined the relationship between ocular discomfort and pterygium clinical characteristics in 40 patients with primary pterygium. Ocular discomfort (as inferred by the Ocular Comfort Index test) was found to be worse in patients exposed to dry and dusty environments, whilst an inverse correlation between ocular discomfort and pterygium corneal area was identified, providing evidence for a loss of corneal sensitivity with pterygium advancement.

*Optometry and Vision Science 90: 269-274*
Ocular aberrations and visual function with multifocal versus single vision soft contact lenses

Gifford and colleagues, based at the University of New South Wales, examined the differences in ocular aberrations and contrast sensitivity function (CSF) caused by wearing centre-near multifocal soft contact lenses (MFCLs), compared to single vision soft contact lenses (SVCLs). Eighteen cyclopleged young adult subjects were fitted with various -3.00 DS contact lenses (Ciba Air Optix Low and High Adds, Bausch and Lomb PureVision Low and High Adds, and PureVision single vision) and underwent aberrometry, and CSF testing at 6 m, 1 m and 40 cm. The MFCLs were associated with a negative shift in primary spherical aberration and a positive shift in secondary spherical aberration. Contrast sensitivity function was not significantly different between contact lens variants at 6 m and 1 m, although at 40 cm, it was reduced with the MFCLs.

Contact Lens and Anterior Eye 36:66-73

Vision Performance With a Contact Lens Designed to Slow Myopia Progression

A new commercially available dual focus MiSight (Coopervision) contact lens is designed to limit the progression of myopia, although there is little peer-reviewed research regarding the lens at present. In this double-masked cross-over study, the investigators studied the visual acceptability of this new lens compared to a typical multifocal contact lens (Proclear Multifocal) in a cohort of young adult subjects who wore each lens design for one week. High illumination- high contrast distance visual acuities were similar for the two lenses and did not differ significantly from those obtained with spectacle correction. However, for low illumination- low contrast visual acuities, those obtained with both contact lenses were poorer at distance, intermediate and near, compared to spectacle correction. Average visual quality ratings were also similar for the two lenses, but lower than with spectacles. The data indicate that the visual performance of the new dual focus lens is similar to that of a typical multifocal contact lens, with some degradation of visual performance due to the presence of multiple optical zones.

Optometry and Vision Science 90: 205-214
Rehabilitation of vision disabling corneal opacities: Is there hope without corneal transplant?

This retrospective review involved the analysis of the records of 158 patients (162 eyes) with poor vision as a result of corneal scarring/opacification, who underwent contact lens fitting, to determine whether an improvement in vision could be made, compared to the spectacle prescription. Around one-quarter of the cohort comprised children under 15 years of age. Rigid gas permeable contact lenses (RGPs) were fitted to 137 eyes, and soft contact lenses to 25 eyes that could not be fitted with RGPs. In 70% of all eyes fitted with contact lenses, visual acuity was at least 2 lines better than with spectacles. The data indicate that significant improvements in visual acuity may be obtained by contact lens fitting to scarred/opacified corneas, even in young children.

*Contact Lens and Anterior Eye 36: 74-79*

Mydriatic Visual Acuity in Diabetic Patients

Heus and colleagues sought to determine whether pupil dilation before refraction in diabetic patients (rather than afterwards) in order to save time and improve efficiency, resulted in any differences in the outcome of examinations and advice given to patients. Three hundred and sixteen patients with diabetes were randomised to receive tropicamide 0.5% either before (experimental group) or after (control group) refraction and visual acuity measurement. No significant differences between the groups were noted regarding advised time until next visit; advice regarding the need to update spectacles and need for further diagnostic tests. The experimental group experienced shorter waiting times and were more likely to be “very satisfied” with their examinations. The data indicate that dilation before refraction in diabetic patients is a clinically-acceptable method of improving efficiency.

*Optometry and Vision Science 90: 249-256*

Efficacy and predictability of laser in situ keratomileusis for low astigmatism of 0.75 D or less

In this retrospective study, the records of 448 eyes of 448 myopic patients with 0.25 to 0.75 D of cylinder that underwent wavefront-optimised laser in situ keratomileusis (LASIK), were reviewed. Patients were split into 3 groups depending on their pre-treatment cylinder magnitude (0.25, 0.50 and 0.75 D). At 4 months post-operatively, there were no differences between groups in terms of mean uncorrected distance visual acuity and mean sphere equivalent refraction, although pre-operative cylinders of 0.50 D or less were frequently over-corrected. The authors therefore advise caution when considering full astigmatic correction of small cylinders.

*Journal of Cataract and Refractive Surgery 39: 366-377*
One-year safety and efficacy results of a hydrogel inlay to improve near vision in patients with emmetropic presbyopia

The Raindrop clear hydrogel corneal inlay for the correction of presbyopia has a diameter of 2 mm and is designed to increase the eye’s refractive power by steepening the central corneal radius of curvature. In this feasibility study, the implant was inserted into the non-dominant eye of 20 emmetropic presbyopes who were followed up for 12 months post-operatively. One patient was dissatisfied with the outcome and underwent explantation, but of the remaining 19 patients, all were satisfied or very satisfied with their overall vision, and 16 of the 19 reported seldom or never wearing spectacles. All patients achieved an uncorrected near visual acuity of 0.3 logMAR by 1 week post-operatively, and maintained at least this level during the course of the follow-up period.

*Journal of Refractive Surgery* 29: 166-172

Visual outcomes and subjective experience after bilateral implantation of a new diffractive trifocal intraocular lens

The FineVision is a relatively new diffractive trifocal intraocular lens (IOL) with an apodised optic to increase distance dominance as pupil size increases. In this UK-based prospective study, 15 patients scheduled for routine cataract surgery underwent bilateral implantation of the trifocal IOL. Two months post-operatively, there were no subjective complaints of dysphotopsia (e.g. glare and haloes), and objective measurement of glare showed scotomas of similar size to those previously reported with multifocal and accommodating IOL designs. Patient satisfaction with unaided near vision, measured using the near activity visual questionnaire (NAV-Q) was high.

*Journal of Cataract and Refractive Surgery* 39: 343-349
Clinical and quality of life data correlation with a single-optic accommodating intraocular lens

The Crystalens HD (Bausch and Lomb) accommodating intraocular lens (AIOL) is designed to move axially with ciliary muscle contraction to generate accommodation, and also features a modified optic to increase the depth of focus of the eye. In this prospective study, 25 eyes of 14 patients aged 52-79 years were implanted with this AIOL during routine cataract surgery, and followed up at 3 months post-operatively. Mean post-operative uncorrected near visual acuity was 0.44 logMAR (approx. 20/50), and most eyes required low adds of between 0.00 and 1.50 D. The achieved intermediate visual acuity was found to correlate with ability to go down steps and to ‘seeing how people react to things that are said’. Defocus curve testing demonstrated that the implant provided a range of clear vision (better than 6/12) or about 1.25D, from distance into the intermediate region. Improvements in near vision were limited by patient age and level of astigmatism.

*Journal of Optometry 6: 25-35*

A Randomized, Single-Center Study of Equivalence of 2 Intraocular Lenses Used in Cataract Surgery

In this interesting randomised control trial, based in Australia, the investigators analysed clinical outcomes following routine cataract surgery in which patients received either an Alcon AcrySof SA60AT intraocular lens (IOL; cost US$215) or a new low-cost TecsoftFlex IOL (Fred Hollows Foundation, cost US$17). The 300 participants were followed up for 12 months post-operatively. The authors found no significant differences between groups in terms of uncorrected and best-corrected distance visual acuities post-operatively, and similar rates of posterior capsular opacification occurred with both implants. Statistically similar results regarding visual function, obtained from VF-14 questionnaires, were also observed between the groups. Generally, little data exists regarding the cost-effectiveness of medical devices, but the present study demonstrates that the new low-cost IOL may represent a suitable alternative to more expensive implants, and could make surgery more affordable for some patients.

*Ophthalmology 120: 482-488*
Factors Affecting Near Vision After Monofocal Intraocular Lens Implantation

It is well known that some patients achieve good unaided near vision following cataract surgery with implantation of monofocal IOLs, due to pseudo accommodative influences. In this retrospective review of 84 eyes of 84 patients who underwent routine cataract surgery, the influence of factors including age; sex; IOL movement; axial length; pupil size; aberrations and astigmatism, on post-operative near vision were assessed. Eyes were classified as having good (at least J4; n = 34 eyes) or poor (<J4; n = 50 eyes) near vision. Of all the factors studied, pupil size less than 2.6 mm and axial length less than 23.0 mm predicted good near vision following routine cataract surgery with monofocal IOL implantation.

*Journal of Refractive Surgery 29: 200-204*

A Longitudinal Analysis of Risk Factors Associated with Central Retinal Vein Occlusion

In this large-scale longitudinal study based in the United States, the risk factors for central retinal vein occlusion (CRVO) were investigated. Medical insurance billing codes were used to identify 1302 cases of CRVO in 494, 165 subjects (0.26 %) over an approximately 5 year period. As was appreciated previously, hypertension and vascular diseases were associated with an increased risk of CRVO, but this study also identified an increased risk in black people, compared to whites. Individuals with uncomplicated diabetes mellitus were not found to be at increased risk of CRVO, although those with end-organ damage related to diabetes did have a heightened risk.

*Ophthalmology 120: 362-370*

Abnormal Thickening as well as Thinning of the Photoreceptor Layer in Intermediate Age-Related Macular Degeneration

Forty-one patients with intermediate non-neovascular age-related macular degeneration (AMD) and 10 age-matched controls were examined using spectral-domain optical coherence tomography. Large drusen (> 125 microns) were analysed, and the thicknesses of the photoreceptor laminae overlying and neighbouring drusen, were measured. In the 63 eyes with intermediate AMD, 750 large drusen were observed, with a mean width and height of 352 microns, and 78 microns, respectively. Reductions in thickness of the photoreceptor laminae overlying drusen were observed compared to age-matched controls, but this study also documented increased thickness of the outer nuclear layer (ONL) in around 20 % of paradrusen regions. A thickening of the ONL in AMD has not previously been reported, and the authors suggest it may represent an early phenotypic marker for photoreceptor stress.

*Investigative Ophthalmology and Visual Science 54: 1603-1612*
The Incidence of Rhegmatogenous Retinal Detachment in The Netherlands

This retrospective study included all patients with rhegmatogenous retinal detachment (RRD) in the Dutch population in 2009 and reviewed surgical records to identify cases of RRD repair. Overall, the annual incidence of RRD was 18.2 per 100,000 people, with a peak incidence in people aged 55-59 years (52.5 per 100,000). Males were found to be significantly more susceptible to RRD than females, with a male to female ratio of 1.3:1. The data show that the occurrence of RRD is highly dependent on patient demographics.

*Ophthalmology 120: 616-622*

Risk of Cardiovascular Diseases Is Increased Even with Mild Diabetic Retinopathy

Kawasaki and colleagues examined data from the Japan Diabetes Complications Study to determine whether mild stage diabetic retinopathy (DR) is associated with a higher risk of coronary heart disease (CHD) and stroke in type II diabetic patients. Prospective data for up to 8 years were gathered. After adjusting for other well-known cardiovascular risk factors, the results demonstrated that even a mild stage of DR (e.g. dot haemorrhages) was associated with a significantly higher risk of both CHD and stroke.

*Ophthalmology 120: 574-582*
Most intriguing research paper title this month:

“Visual performance fall-off with eccentricity in myopes versus emmetropes”

The Contrast Acuity Assessment (CAA) test was designed to assess an individual’s dynamic visual performance under photopic and mesopic conditions. In this UK-based study, the authors used a modified version of the CAA to measure high contrast resolution acuity in central and peripheral locations in emmetropes and myopes. Myopes showed a more rapid fall-off in peripheral visual performance compared to emmetropes, although central performance was similar between the groups. The authors hypothesise that peripheral retinal thinning and possible damage to retinal neurons in axial myopia might be responsible for the poorer performance of the peripheral retina in myopic eyes.

Journal of Optometry 6: 36-44

Most fascinating research finding this month:

A Yellow Filter Improves Response Times to Low-Contrast Targets and Traffic Hazards

In light of anecdotal evidence suggesting that some users prefer yellow tinted lenses for outdoor activities, this study sought to determine whether yellow lens filters resulted in objective improvements in performance for visual tasks relevant to driving. Young subjects (mean age 31.4 years) were found to respond more quickly to driving hazards in video presentations when wearing a yellow filter compared to a neutral density filter, and in a second task which involved identifying the presence of low-contrast gratings, responded more quickly when the yellow filter was combined with a polarizer. The beneficial effects of yellow filters for driving tasks were not observed amongst older participants (mean age 74.6 years).

Optometry and Vision Science 90: 242-248

Next report
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