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 second research update of 2013, where the optometry and ophthalmology journals listed below are reviewed. This month we see that in the field of contact lenses, rigid lens fitting continues to decline, and many astigmats could benefit from simple fitting with toric soft contact lenses. In anterior eye research, heavy drinking in males is found to be associated with adverse effects on the tear film, whilst laser scanning confocal microscopy can be used in vivo to analyse the effects of glaucoma medications on the meibomian glands. Relating to cataract surgery, new research indicates that the efficacy of intraocular lens power calculations may be limited by normal fluctuations in keratometry readings over time, and some patients with smaller pupils may gain no additional benefit from aspheric intraocular lenses. As usual, the most intriguing research paper title and most fascinating research finding of the month conclude the update.

### Issue 35

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Severe Limbal Stem Cell Deficiency From Contact Lens Wear

A stable corneal epithelium relies on normal limbal stem cells, which also act as a barrier to prevent conjunctival epithelial cells invading the cornea. There is limited literature relating to severe limbal stem cell deficiency arising from contact lens wear (which may not be recognised/diagnosed by ophthalmologists), so this retrospective study was designed to describe the characteristics of the condition in a larger cohort. Records relating to 18 eyes of 12 patients were reviewed; the mean age at presentation was 42 years, and the mean duration of contact lens wear was 14.1 years. Vision was decreased in all eyes, and ranged from 20/30 to 20/250. Photophobia and pain were common symptoms, as was ocular redness. Conservative treatment using topical steroids and artificial tears was unsuccessful in all cases, so 14 eyes underwent limbal stem cell transplantation and systemic immunosuppression; 12 of these eyes had total symptom resolution after approximately 2 years.

*American Journal of Ophthalmology* 155: 544-549

Clinical Evaluation of Fitting Toric Soft Contact Lenses to Current Non-users

Two hundred subjects at 16 UK sites participated in this one-month bilateral study evaluating the efficacy of fitting toric soft contact lenses to spherical lens wearers (n = 67); previous toric drop-outs (n = 72), or neophytes (n = 61). Subjects were fitted with either a daily disposable toric contact lens or a 2-weekly reusable toric lens. One hundred and eighty two subjects completed the month-long study; success rates for toric lens wear were high in all three groups at 80%, 74% and 70% for the initial spherical lens wearers, drop-outs and neophytes, respectively. Poor comfort was the most common reason for drop out. Previous spherical lens wearers had significantly better visual acuities with the toric lenses. The data indicate that many astigmats who do not currently wear toric soft contact lenses could benefit from (re)fitting.

*Ophthalmic and Physiological Optics* 33: 94-103
International Survey of Rigid Contact Lens Fitting

This paper reports on rigid contact lens fitting trends in 40 countries, between 2007-2011. Data relating to approximately 130,000 contact lens fits were obtained; rigid contact lenses accounted for 10.8% of fits, ranging from 0.2% in Lithuania to 37% in Malaysia. Orthokeratology accounted for 11% of rigid lens fits. The data shows that rigid contact lens fitting has continued to decline since 1996, but rigid lenses are likely to become a more specialised form of vision correction.

Optometry and Vision Science 90: 113-118

In Vivo Confocal Microscopy of Meibomian Glands in Glaucoma

Previous studies have indicated that long-term treatment with glaucoma medications can lead to morphological changes and dysfunction of the meibomian glands (MGs). This Italian study used in vivo laser scanning confocal microscopy (LSCM) to investigate the changes in MGs that occur with glaucoma medication. Eighty glaucomatous eyes and 20 control eyes were included in the study. Eyes treated with 2 or more glaucoma medications showed lower mean acinar density and mean acinar area, greater secretion reflectivity and glandular orifice area, compared to control eyes. Preserved prostaglandin analogues (PGAs) were associated with more pronounced changes in all parameters than non-preserved PGAs. The study demonstrated the value of LSCM in examining MG changes in glaucoma patients, and provided some evidence that preservative-free medications may be advisable.

British Journal of Ophthalmology 97: 343-349
Patient Satisfaction with Topical Ocular Hypotensives

The Treatment Impact Patient Satisfaction Scale (TIPSS) was completed by 2541 glaucoma and ocular hypertension patients receiving ocular hypotensives in New Zealand. The TIPPS evaluates satisfaction related to convenience, ease of administration and side effects. Around 80% of respondents were satisfied/very satisfied with ocular hypotensives; male gender was associated with lower satisfaction, but the duration of use, age and side effects were not predictive of satisfaction. Non-compliance may be associated with reduced satisfaction, hence males may be more non-compliant with treatment. The data indicated that convenience and ease of administration should be addressed to improve patient satisfaction.

*British Journal of Ophthalmology 97: 343-349*

The Changes in Tear Film Parameters and Impression Cytology in Heavily Drinking Men

Tear film characteristics in 35 heavy drinking males were compared with those of a group of 35 age- and sex-matched controls in this prospective study. Schirmer I test values and mean break-up times were significantly lower and impression cytology scores were higher in the heavy drinkers than in the controls. The data indicate that heavily drinking males have decreased tear production and more unstable tear films, along with significant degeneration of the ocular surface epithelium, compared to controls.

*Cornea 32: 237-241*
Femtosecond Laser-Assisted Small-Aperture Corneal Inlay Implantation for Corneal Compensation of Presbyopia

The Kamra inlay is an opaque disc-like implant designed to increase the depth-of-focus of the eye to improve near vision in presbyopic patients. In this prospective study, emmetropic presbyopes were implanted with the Kamra in their non-dominant eye, using a femtosecond laser created corneal pocket, and followed up for 2 years post-operatively. At 24 months, the mean uncorrected distance visual acuity was 20/20 in the operative eye and 20/16 binocularly. Contrast sensitivity values decreased slightly, but remained within the range of the normal population. No inlays required explantation during the course of the follow-up period. The results indicate that the technique is both effective and safe for the correction of presbyopia in emmetropes.

Journal of Cataract and Refractive Surgery 39: 234-241

Change in Efficiency of Aspheric Intraocular Lenses Based on Pupil Diameter

Aspheric intraocular lenses (IOLs) may be implanted during cataract surgery to improve visual outcomes by reducing spherical aberration, and improving contrast sensitivity. In this retrospective cross-sectional study, Eom and colleagues examined 169 eyes of 86 patients implanted with either the Hoya AF-1 NY-60 or the Tecnis ZCB00 1-piece IOL. One month post-operatively, ocular, corneal and internal spherical aberrations were measured using a commercially-available wavefront analyser and the minimum pupil diameter required for each IOL to be effective was determined from linear regression equations. The aspheric benefits of the IOLs reduced to 0 % at pupil diameters of 3.47 and 3.71 mm for the Tecnis and Hoya implants, respectively. Under mesopic conditions, around 10% of eyes had pupil sizes smaller than the minimum effective pupil diameters. The data indicate that patients with small pupil sizes may not benefit from aspheric IOLs.

American Journal of Ophthalmology 155: 492-498
Systemic Absorption of Mitomycin-C When Used in Refractive Surgery

In this study of 30 patients who underwent photorefractive keratectomy with mitomycin C (MMC; an agent used to reduce the risk of post-operative corneal haze), a blood sample was taken immediately following 30 seconds of treatment with MMC 0.2%. Plasma samples underwent laboratory analysis to determine whether MMC was present and had therefore undergone systemic absorption from the topical application. MMC was not detected in any of the samples analysed, providing valuable information for pre-refractive surgery counselling; patients may be advised of an extremely low risk of systemic absorption and toxicity from topical MMC.

*Journal of Cataract and Refractive Surgery 39: 234-241*

Fluctuations in Corneal Curvature Limit Predictability of Intraocular Lens Power Calculations

This case series study, based at Moorfields Eye Hospital, London, evaluated temporal fluctuations in corneal curvature in cataract surgery patients. Keratometry was measured pre-operatively, and several times post-operatively (up to 2 years) in 50 patients who underwent surgery on both eyes. Surgically-induced astigmatism typically consisted of mild flattening in the horizontal meridian, and mild steepening obliquely, however, random fluctuations were found to be far more significant, and not linked to the accuracy of measurements. The accuracy of intraocular lens calculations may therefore be limited by these normal fluctuations over time.

*Journal of Cataract and Refractive Surgery 39: 174-179*
Surgical Outcomes and Safety of Femtosecond Laser Cataract Surgery

Roberts and colleagues describe surgical outcomes and safety data relating to 1500 consecutive eyes undergoing femtosecond laser cataract surgery at a single private clinic by a group of surgeons. Anterior capsule tears, posterior capsule tears and posterior lens dislocation were all more common in the first 200 patients, as were the number of docking attempts and anterior capsular tags compared to the subsequent 1300 patients. The data indicated greater surgeon experience and modified surgical technique are associated with better outcomes in femtosecond laser cataract surgery.

*Ophthalmology* 120: 227-233

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
Diagnostic Reliability and Normative Values of Stereoacuity Tests in Preschool-Aged Children

This interesting study, based in Australia, examined 1606 children aged between 24-72 months to determine normal ranges for stereoacuity and investigate the diagnostic accuracy of several stereoacuity tests. All children underwent a full eye examination and stereoacuity testing with Lang II. The Stereosmile stereoacuity test (SSST) was performed on the younger children (< 30 months) and older children who were unable to perform the Randot PreSchool stereoacuity test (Randot). Younger children who passed both Lang II and SSST were also tested with Randot. For the 24-47 month age group, modes for the Lang II, SSST and Randot were 200, 120 and 100 secs of arc, respectively. For the 48-72 month age group, modes for the same tests were 200, 60 and 60 secs of arc, respectively. Statistical testing indicated that the Randot test was most reliable for detecting ocular conditions (amblyopia/ strabismus/ anisometropia).

British Journal of Ophthalmology 97: 308-313

Ranibizumab for Edema of the Macula in Diabetes Study

Do and colleagues evaluated the effect of increased follow-up and more intensive ranibizumab treatment between months 24 and 36 in the Ranibizumab for Edema of the Macula in Diabetes Study (READ-2). Seventy- four participants, who had previously received ranibizumab, laser, or laser and ranibizumab treatment were followed up on a monthly basis, and received ranibizumab 0.5 mg if their foveal thickness was 250 microns or greater. Those in the ranibizumab group showed the greatest improvement between months 24 and 36, with a mean improvement of 3.1 letters on visual acuity testing, and a 70 micron reduction in foveal thickness. The data indicate that more frequent injections of ranibizumab and more long-term follow up are required to optimise visual outcomes in diabetic macular oedema.

JAMA Ophthalmology 131:139-145
What Factors are Associated with Myopia in Young Adults?

Male Taiwanese military conscripts aged 18-24 years were examined using non-cycloplegic autorefraction, ocular biometry and questionnaires to identify the factors associated with myopia in this population. Data from 5,048 subjects were included in the analysis. The prevalence of myopia (at least -0.50 D in the right eye) was high at 86.1 %, with a mean refractive error of -3.66 ± 2.73 D, and mean axial length of 25.40 ± 1.38 mm. The data provided evidence of the multifactorial nature of myopia in young Taiwanese men; older age, myopic parents, high educational level, more time spent reading, high urbanisation level and less time spent outdoors were all associated with longer axial lengths and myopia. Less time outdoors was only associated with low-moderate myopia, and not levels of ≤ -6.00 D.

Investigative Ophthalmology and Visual Science 54: 1026-1033

Identification of a Candidate Gene for Astigmatism

Astigmatism is believed to be associated with both genetic and environmental factors. This meta-analysis of 7 genome-wide association studies included data on 22,100 European individuals. A susceptibility locus for astigmatism was identified on the VAX2 gene, which is important in the development of the dorsoventral axis of the eye. This finding furthers our understanding of refractive error and suggests new areas for research into astigmatism.

Investigative Ophthalmology and Visual Science 54: 1260-1267

Children’s Accommodation During Reading of Chinese and English Texts

Given that myopia is so prevalent in Singapore, and inaccurate accommodation is linked with myopia, this study investigated the theory that reading Chinese text, compared to English, may be associated with poorer accommodation. Yeo and colleagues used an open-view autorefractor to measure accommodative accuracy and nearwork induced transient myopia (NITM) in 83 children (43 myopes, 40 emmetropes) who read Chinese and English texts at 25 and 33cm. Reading the Chinese text was associated with smaller accommodative lags than the English text, but the differences were not clinically significant. Myopes showed greater NITM and longer regression than emmetropes for both texts. It remains unclear whether differences in NITM are a cause effect of myopia.

Optometry and Vision Science 90: 156-163
Most fascinating research finding this month:

Green Tea Is Neuroprotective in Diabetic Retinopathy

In this animal study, diabetes was induced in laboratory rats, who then received green tea orally for 12 weeks. Alterations occurring in the diabetic animals included increases in oxidative retinal markers and glutamine synthetase levels, and in hypertensive rats, blood-retinal barrier breakdown and impaired electroretinography results. Treatment with green tea was found to restore the effects occurring in diabetic animals, and protect the retina against neurodegeneration.

*Investigative Ophthalmology and Visual Science* 54: 1325-1336

Most intriguing research paper title this month:

Are Polymegethism, Pleomorphism, and “Poor Swelling” Valid Discard Parameters in Immediate Postmortem Evaluation of Human Donor Corneal Endothelium?

In this retrospective study, Bruinsma and colleagues determined that eye bank corneas demonstrating endothelial polymegethism, pleomorphism, and “poor swelling” often recover a normal endothelial mosaic and “normal swelling” between 7 and 21 days after excision of the corneoscleral button. Just 14% (n = 59) of corneas still showed any of these characteristics at the later tissue evaluation. The data indicate that use of endothelial cellular contour morphology in assessing the viability of a donor cornea for transplantation may require reconsideration.

*Cornea* 32: 285-289