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 April 2013 research update, in which the optometry and ophthalmology journals listed below are reviewed. In the peer-reviewed literature this month, continuing long-term improvements are observed after collagen cross-linking for keratoconus, whilst further research explores the use of contact lenses in drug delivery and for the modification of peripheral refraction in myopia. In the field of cataract surgery and intraocular lenses, evidence of a reduction in visual field sensitivity in eyes implanted with multifocal intraocular lenses is presented, along with confirmation of the benefits of binocular summation in patients receiving bilateral multifocal implants in another paper. As usual, the update concludes with the most fascinating research finding of the month and the most intriguing paper title.

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Long-term follow-up of riboflavin/ultraviolet A (370 nm) corneal collagen cross-linking to halt the progression of keratoconus

Riboflavin/ultraviolet corneal collagen cross-linking (CXL) is the first treatment that is able to halt the progression of keratoconus. The treatment is relatively new and as such, there is a lack of long-term data on the efficacy of CXL. In this UK-based study, 29 eyes of 29 patients who had undergone CXL between 4 and 6 years previously were examined. The mean age of subjects at the time of treatment was 26.3 years. The data showed that CXL is safe and efficient 4-6 years post-operatively; no treated eyes demonstrated progression of keratoconus or lost more than 1 line of corrected distance visual acuity (CDVA). Interestingly, improvements in spherical equivalent refractive error, CDVA, mean sim K and cone apex power noted at 12 months, continued to improve to the 4-6 year follow-up stage.

*British Journal of Ophthalmology 97: 433-437*

Compliance with Lens Replacement and the Interval between Eye Examinations

It is well known that a proportion of patients do not follow recommendations for the replacement of their contact lenses. This US questionnaire-based study included 2,147 responses from both contact lens patients and their practitioners to examine the relationship between contact lens compliance and the interval between eye examinations, along with other factors. Patients wearing 2 weekly replacement silicone hydrogels were significantly less compliant with replacement frequency than those wearing daily or monthly disposables. Patients who were not compliant with the recommended replacement schedule had significantly longer intervals between eye examinations. Those patients who purchased lenses from their eye care practitioner were more likely to have higher household incomes, have relevant healthcare insurance and were female, with shorter intervals between examinations.

*Optometry and Vision Science 90: 378-384*
Peripheral refraction with dominant design multifocal contact lenses in young myopes

Myopia correction can induce relative peripheral retinal hyperopia, which may act as a trigger for further myopic growth. It has been hypothesised that correction of this peripheral refraction or conversion to relative peripheral myopia, with speciality spectacles or contact lenses may retard myopia progression. In this prospective study of young adult myopes, it was demonstrated that a commercially available multifocal soft contact lens (Proclear Multifocal D design) can induce a significant peripheral myopic shift, particularly the +3.00 D add variant. The data are interesting as they show the potential for a readily-available contact lens to modify the peripheral optics of myopic eyes which could potentially be treated with such lenses.

*Journal of Optometry 6: 85-94*

Development and Efficacy of a Drug-Releasing Soft Contact Lens

Ocular drug delivery is complex, and complicated by the fact that the cornea absorbs only a very small proportion of drops instilled into the eye. As such, patients are frequently advised to instil drops very frequently, which can reduce compliance. In this Japanese study, the authors describe in-vivo use of a new hydrogel contact lens designed for drug delivery. In rabbit eyes, the contact lenses delivered antibiotics into the interior eye over several days, and were more effective than eye drops. The authors suggest possible human use after cataract surgery, after which anti-infectives are essential, particularly because the contact lens would also have a bandage effect for the incision.

*Investigative Ophthalmology and Visual Science 54: 2551-2561*

Iris Nevus Growth into Melanoma: Analysis of 1611 Consecutive Eyes

Iris melanoma is clinically important as it may require enucleation and lead to metastasis. In this retrospective analysis, the malignant transformation rate for iris naevi initially diagnosed as benign was found to be 8% over 15 years. The mean age of patients receiving iris naevus referral was 51 years. The mnemonic ABCDEF was described by the authors to define the risk factors associated with malignant transformation: age; blood (hyphaema); clock hour inferior (4 to 9 o’clock); diffuse configuration; ectropian uveae and feathery margins. Patients who underwent malignant transformation were significantly younger than those that did not (mean ages 39 vs 52 years). The data indicate that patients with iris naevi and ABCDEF clinical features should undergo periodic monitoring.

*Ophthalmology 120: 766-772*
Correlation of visual quality with satisfaction and function in a normal cohort of pseudophakic patients

Kinard and colleagues, based in Utah, examined the association between various visual quality parameters and overall subjective satisfaction with vision in 70 patients who had undergone uneventful cataract surgery with implantation of a hydrophobic acrylic monofocal intraocular lens at least 12 months previously. Parameters investigated included corrected distance visual acuity (CDVA), low contrast CDVA, straylight measurement, NEI VF-11R visual function questionnaire, a custom dysphotopsia survey and a question of overall satisfaction. Overall, the patients had high levels of satisfaction following cataract surgery. Only the results of the NEI VF-11R questionnaire and dysphotopsia correlated with overall satisfaction. Given that the dysphotopsia and satisfaction questionnaire results were strongly correlated, the data indicate that dysphotopsia has an important functional significance.

Journal of Cataract and Refractive Surgery 39: 590-597

Evaluation of Corneal Displacement during Non-contact Tonometry

This interesting study used high-speed digital photography to examine corneal displacement during non-contact tonometry, performed with the Topcon CT-80A. Images from 13.2 and 30 ms (early and late phases) after the air puff were analysed. Amongst the cohort of 61 subjects, young females showed the smallest displacement, whilst older females had the largest levels of corneal displacement. The results suggest that corneal rigidity may change more with age in females, compared to males. In agreement with previously published work, higher IOPs and increased central corneal thickness were associated with reduced corneal displacement.

Investigative Ophthalmology and Visual Science 54: 2474-2482
Additional multifocal sulcus-based intraocular lens

Supplementary multifocal intraocular lenses (IOLs) implanted into the ciliary sulcus offer a potentially reversible approach to multifocality for pseudophakic patients with an existing in-the-bag IOL. In cases of non-tolerance, the supplementary IOL can be simply removed without the risk of complications such as capsular bag trauma or zonular damage. In this prospective randomised trial, Schrecker and colleagues compared visual outcomes with a sulcus-fixed additional multifocal IOL (MS 714 Diff, with a monofocal IOL implanted in-the-bag during the same session) to a standard multifocal IOL (MS 612-Diff). At 3 months post-operatively, uncorrected distance and near visual acuities were good, with no significant differences between the 2 groups. Defocus curves were equivalent between the groups, although contrast sensitivity was better in the supplementary IOL group. The data indicate that supplementary multifocal IOLs can provide equivalent visual function to a standard multifocal IOL, but with the potential for removal, should non-tolerance occur.

Journal of Cataract and Refractive Surgery 39: 548-555

Relation between Uncorrected Astigmatism and Visual Acuity in Pseudophakia

Understanding the effect of uncorrected astigmatism on visual acuity in pseudophakia is important as it may dictate the need for astigmatic correction during or after cataract surgery. Singh and colleagues examined the effect of induced astigmatism and pupil size on distance and near visual acuities in 15 emmetropic pseudophakes implanted with monofocal intraocular lenses. Up to 1 D of myopic astigmatism was found to improve near visual acuity, with a corresponding reduction in distance acuity. Above 1 D of myopic astigmatism, a significant reduction in distance acuity was observed, with no beneficial effect on near vision. As might be expected, distance and near acuities in astigmatism improved significantly as pupil size reduced (using artificial pupils). Uncorrected hyperopic astigmatism of all levels reduced distance and near visual acuities.

Optometry and Vision Science 90: 378-384
The 10-Year Incidence and Risk Factors of Retinal Vein Occlusion

As part of the Beijing Eye study, Zhou and colleagues investigated the 10-year incidence and factors associated with retinal vein occlusion (RVO) in adult Chinese subjects. Data from 2695 subjects aged 40 years and over at baseline in 2001 were analysed. Overall, the 10 year incidence of RVO (1.9 ± 0.1 per 100 persons) was similar to that previously reported in Caucasian populations. Branch RVO was approximately 6 times more common than central RVO. The incidence of RVO was associated with hypertension, high blood cholesterol levels and lower cognitive function scores. The intake of aspirin was not significantly related to the incidence of RVO.

*Ophthalmology 120: 803-808*

Binocularity Enhances Visual Acuity of Eyes Implanted With Multifocal Intraocular Lenses

There is a lack of data on the potential gain in visual acuity (VA) as a result of binocular vision with multifocal intraocular lenses (IOLs); this study investigated monocular and binocular VAs at distance, intermediate and near in 20 patients who had undergone bilateral cataract surgery with implantation of AcrSof IQ ReStor multifocal IOLs approximately 2 years previously. Binocular summation (the difference between an individual’s binocular and best monocular visual acuities) was found to be statistically significant at all 3 testing distances, confirming a benefit of binocular rather than monocular implantation of multifocal IOLs in terms of visual acuities.

*Journal of Refractive Surgery 29: 246-250*

Influence of Multifocal Intraocular Lenses on Standard Automated Perimetry Test Results

Multifocal intraocular lenses (MFIOLs) are becoming increasingly popular, but concerns have previously been raised suggesting that they may hinder post-operative examination of the fundus and visual fields testing. In this cross-sectional study, the authors performed SITA 30-2 testing (size III stimulus) and full threshold testing (size V stimulus) with a Humphrey automated perimeter in 16 patients implanted with diffractive MFIOLs, 18 healthy phakic volunteers and 12 monofocal pseudophakes. The results indicated that eyes implanted with MFIOLs demonstrate a significantly increased mean deviation on SITA testing and reduced mean sensitivity on full-threshold testing, compared to monofocal IOL patients and healthy volunteers. The reduction in sensitivity could interfere with glaucoma screening and management.

*JAMA Ophthalmology 131: 481-485*
Does amblyopia have a functional impact?

Whilst amblyopia is associated with a number of visual deficits and adaptations, the functional impact of amblyopia on “real life” outcomes is poorly understood. This interesting study, based in Dunedin, New Zealand, examined the effect of unilateral amblyopia on motor development, teenage self-esteem and adult socio-economic status amongst a large cohort of 1,137 children born in 1972-3 and followed up longitudinally as part of the Dunedin Multidisciplinary Health and Development Study. The data indicated that amblyopia does not have a negative impact on the real life outcomes examined, with no difference between those with amblyopia/ recovered amblyopia and non-amblyopes in terms of gross or fine motor development or teenage self-esteem, as measured by the Rosenberg self-esteem scale. Amblyopia was not associated with the highest educational qualification obtained by age 32 years, or other measures of socio-economic status.

Clinical and Experimental Ophthalmology 41: 127-134

Is sunlight exposure a risk factor for age-related macular degeneration?

Sui and colleagues, based in China, undertook a systemic review and meta-analysis to examine the possible link between age-related macular degeneration (AMD) and sunlight exposure. The relationship between AMD and sunlight has been disputed over a number of years, with some conflicting results in previously published epidemiological studies. Fourteen suitable studies were included in the analysis, which indicated overall that individuals with higher levels of sunlight exposure being at a significantly greater risk of developing AMD. The gross domestic product (GDP) per capita, but not latitude, was identified as a factor that affected the risk of AMD, with the relative risk decreasing as GDP increased.

British Journal of Ophthalmology 97:389-394
### Background chromatic contrast preference in cases with age-related macular degeneration

This interesting study based in a clinical setting, examined the background chromatic contrast preferred by patients with age-related macular degeneration (AMD), compared to a control group of healthy volunteers. Blue, yellow, green and red coloured overlays were trialled in each participant, who stated whether they preferred each overlay compared to no overlay for viewing text. Both the AMD patients and controls had a preference for the yellow overlay, although the preference was significantly stronger among the AMD patients. The authors propose that the use of yellow hues as background contrast in AMD patients requires more widespread investigation.

*Journal of Optometry 6: 80-84*

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### Prevalence of Refractive Errors in a Multiethnic Asian Population

This large-scale study of 10,033 adults in Singapore explored the prevalence of refractive errors amongst people aged over 40 of different ethnicities (Chinese, Indians and Malays). Singapore is highly urbanised and has been described as experiencing an “epidemic of myopia.” The overall prevalence of myopia (at least -0.50 D) amongst this age group was 38.9 %, which is lower than the younger “myopia generation” in Singapore, which has previously been shown to have a myopia prevalence of around 80 %. Chinese people had the highest prevalence of myopia, and longest axial lengths. Compared to data collected 12 years previously, axial lengths and levels of myopia and astigmatism are steadily increasing amongst the Chinese population.

*Investigative Ophthalmology and Visual Science 54: 2590-2598*
Most fascinating research finding this month……

Antibiotic Resistance of Ocular Surface Flora With Repeated Use of a Topical Antibiotic After Intravitreal Injection

Intravitreal (IVT) injections have become more widely used in recent years, particularly for the treatment of neovascular age-related macular degeneration. These patients typically undergo a course of several IVT injections; infectious endophthalmitis is a rare, but very dangerous potential complication of such injections. This prospective 3 month study investigated the change in antibiotic resistance of the ocular surface flora with repeated use of prophylactic antibiotics in 84 patients after IVT injections; a control group of 94 patients was also studied. The data indicated that repeated antibiotic use significantly increases the antibiotic resistance of ocular surface flora. The authors recommend that the routine use of prophylactic antibiotics should therefore be avoided following IVT injections to avoid more virulent cases of endophthalmitis, caused by more resistant bacteria.

*JAMA Ophthalmology* 131: 456-461

Most intriguing research paper title this month……

“Eyes in Various Species Can Shorten to Compensate for Myopic Defocus”

Previous animal work in the field of myopia has indicated that eyes are able to alter their rate of ocular elongation (and myopia progression) in response to induced retinal defocus. This study sought to examine whether the eye could actually shrink when needed, rather than just cease its elongation. Chicks, tree shrews, marmosets and macaques were studied, and it was found that all of the species, particularly the tree shrew, could shorten axially to compensate for myopic defocus. The authors suggest that active ocular shortening is controlled by local ocular mechanisms, rather than the brain. The results indicate that myopia could one day be reversed (rather than just retarded) in humans by combining distance refractive correction with some form of myopic defocus.