

Cataract- Posters

Saturday 15 June

Paper #1

Can functional vision and patient satisfaction be achieved with a combination approach to implanting presbyopia-correcting intraocular lenses?

Andrea L. Butler, Bonnie An Henderson

**Purpose** To evaluate visual outcomes and patient satisfaction with monocular implantation of presbyopia-correcting intraocular lenses (IOLs) in a variety of combinations.

**Study Design** Retrospective case series.

**Methods** Retrospective review was performed of all charts of patients implanted with presbyopia-correcting IOLs over 7 years (2005-2012). All records of patients implanted with a presbyopia-correcting IOL in one eye, and a fellow eye that was either phakic, aphakic or implanted with a different IOL were included. No chart was excluded. Patient characteristics (age, gender, occupation, work status), preoperative symptoms and functional impairment, best-corrected distance (BCDVA), near visual acuities (BCNVA), brightness acuity testing (BAT), preoperative spectacle-dependence, postoperative symptoms, postoperative patient satisfaction and degree of postoperative spectacle-dependence were collected.

**Results** Twenty patients with different combinations of presbyopia-correcting IOLs were included. All patients were dissatisfied with outcomes after first IOL implantation for various reasons. Patients were subdivided into 5 resultant differing groups: accommodating-phakic (n= 3), multifocal-phakic (n= 4), multifocal-aphakic (n= 1), multifocal-monofocal (n= 6), and multifocal-accommodating (n= 6). Of these 20 patients, 19 (95.0%) were either "content" or "very happy" with their postoperative visual outcomes overall, and only 1 patient (5.0%) was considered to be "unhappy" overall due to generalized visual discomfort in the early postoperative course.

**Conclusions** This study suggests that a combination approach to implanting presbyopia-correcting IOLs is well-tolerated by patients, and the functional vision that is achieved results in patient satisfaction even if dissatisfied with first IOL choice.

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Paper #2

Prospective study of Intraoperative Floppy Iris Syndrome (IFIS) incidence in Barcelona using intracameral phenylephrine

Francesc March, Paulina López, Anna March

Purpose determine in patients taking tamsulosin and who underwent cataract surgery, the effect of intracameral phenylephrine prophylaxis on the incidence and degree of IFIS and complications.

Study Design prospective study

Methods We reviewed the records of all patients undergoing cataract surgery between 2009 and 2010. Notes were studied for patients taking tamsulosin at the time of surgery. Intracameral phenylephrine prophylaxis was available to surgeon decision, applied at the beginning of the surgery. IFIS was defined and classified by the presence of any of the three phenomena that constitute the syndrome.

Results 3156 cataract consecutive surgeries identified 64 patients (99 eyes) taking tamsulosin; the overall incidence of possible IFIS in the total of patients was 3.1%. Two groups were distributed if intracameral phenylephrine prophylaxis was used. In the non-intracameral phenylephrine group was observed no IFIS in 32% of the eyes, IFIS grade 1 in 11%, IFIS grade 2 in 39% and IFIS grade 3 in 18%. In the intracameral phenylephrine group was observed no IFIS in 89% of the eyes, IFIS grade 1 in 9% and IFIS grade 2 in 3%. The complications were rupture of the posterior capsule with vitreous loss occurring in two eyes (2%) in which intracameral phenylephrine was not used, and IFIS grade 3 was observed.

Conclusions The incidence of IFIS in eyes without receiving intracameral phenylephrine was 68%, similar to other publications. The incidence of IFIS in eyes receiving intracameral phenylephrine prophylaxis was 12%. In this group the operating time was shorter and there were fewer complications.

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Paper #3

Do different methods for measuring corneal power and axis affect lens selection for TORIC IOL implantation?

John T. Gonder, Jit Gohill

**Purpose** To compare various methods for measuring the power and axis of corneal astigmatism prior to cataract extraction and TORIC IOL insertion.

**Study Design** Retrospective case series

**Methods** All patients who underwent cataract surgery with TORIC IOL insertion over a 15 month period with a single surgeon were reviewed. Corneal astigmatism was measured preoperatively with manual keratometry and/or automated optical biometry and/or corneal topography. Eyes that were measured with more than one method were identified. The difference between astigmatism measurements using different instruments on the same eyes were calculated. These difference in these measurements were analysed to determine their statistical and clinical significance.

**Results** 149 eyes had manual keratometry and automated optical biometry. 86 of those eyes also had corneal topography.

In the 149 eyes that had manual keratometry and automated optical biometry the difference in power measured was 0.11 D ( $p=0.002$ ) and would have resulted in a different lens selection in 50% of eyes. The difference in axis measured was  $6.09^\circ$ .

The 86 eyes that had manual keratometry and corneal topography the difference in power measured was 0.097 D ( $p=0.037$ ) and would have resulted in a different lens selection in 21% of eyes. The difference in axis measured was  $7.02^\circ$ .

The 86 eyes that had automated optical biometry and corneal topography the difference in power measured was 0.217 D ( $p=0.0002$ ) and would have resulted in a different lens selection in 24% of eyes. The difference in axis measured was  $7.50^\circ$ .

**Conclusions** There is a significant difference in the measurement of corneal astigmatism when using either manual keratometry, automated optical biometry, or corneal topography prior to cataract surgery with TORIC IOL implantation. This difference could result in different lens power selection and axis placement. Preoperative measurement has to be included as a possible source of variation in outcome along with intra-operative marking and lens rotation. Surgeons should analyze their refractive outcomes after cataract surgery with TORIC IOL insertion and ensure their chosen method of corneal astigmatism measurement is resulting in optimal refractive outcomes.

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Paper #4

Retrospective study of Intraoperative Floppy Iris Syndrome (IFIS) incidence in Barcelona

Francesc March, Anna March

**Purpose** The purpose was to determine the incidence of IFIS in patients who underwent cataract surgery and the relationship with previous visits to the urology service in our environment.

**Study Design** A retrospective chart review of consecutive cataract surgeries performed between 2006 and 2007.

**Methods** IFIS was defined by the reported presence of any of the three signs that constitutes the syndrome; and suspicion of IFIS was defined by the presence of incidents directly related to an abnormal behavior of the iris. The visits to the urology service previous to the surgery were recorded; as an indirect measure of medications prescribed for urinary symptoms intake.

**Results** The review of 4406 records identified 49 patients (56 eyes) who had IFIS or were suspected of IFIS. The incidence of IFIS was 1.27%. The IFIS reports could be classified in: low to moderate in 28 eyes; and grave in 12 eyes; the suspicion of IFIS was detected in 16 eyes. All the complications were observed in the group with previous visit to the urology department, it succeeded 4 posterior capsule ruptures that could be associated with IFIS. The range surgical times were of  $33,5 \pm 7,9$  minutes in no IFIS report to  $42 \pm 10,8$  minutes in IFIS report.

**Conclusions** The incidence of IFIS may be related to the previous visit to the urology department of the patients. The occurrence of IFIS was associated with higher surgical times. The incidence of IFIS in the rate was lower than most publications but are consistent with other retrospective studies

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Paper #5

Impact of microvacuoles on optical performance of hydrophobic acrylic IOLs.

George Beiko, Patricia Piers, Marrie vanderMooren, Michelle Langeslag

**Purpose** To determine the quality of image formation with current hydrophobic acrylic IOLs, using a laboratory setup.

**Study Design** laboratory design

**Methods** Current available hydrophobic acrylic IOLs were studied. All IOLs were of the same dioptric power. By cycling the lens from room temperature to eye temperature (in saline in an oven at 35°C overnight) different amounts of micro vacuoles (glistenings) were induced, approximating the in vivo condition. The number and area covered by glistenings were determined and analyzed using dark field photos and a confocal microscope. MTF and straylight scatter were measured on an optical bench in average cornea eye model before the cycle (base); and 2 hours after taking the IOL out of the oven (t=2h).

**Results** Confocal images will be presented. Microvacuoles had no effect on MTF. All lenses tested have straylight levels lower than that published for a 70 year old healthy human crystalline lens. All lenses without microvacuoles have straylight levels lower than that published for a 20 year old healthy human crystalline lens; lenses with glistenings have straylight levels greater than a 20 year old lens. Multifocal lenses with glistenings have straylight levels approaching that published for a 70 year old human crystalline lens.

**Conclusions** The presence of microvacuoles in hydrophobic acrylic intraocular lenses increases straylight levels and can impact adversely on visual performance.

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Paper #6

Macular schisis as a post-operative event of cataract extraction

Jit Gohill, Salina Teja, Emi Sanders

**Purpose** Macular schisis is an extremely uncommon complication of cataract surgery, and there are currently no cases reported in the literature. Our purpose is to describe 10 eyes with development of post-operative macular schisis after cataract extraction and intraocular lens placement (CE+IOL).

**Study Design** Retrospective case series

**Methods** 10 eyes of 10 patients who developed macular schisis on post-operative day 1 after CE+IOL presented with a subacute decrease in visual acuity. These patients were evaluated by ocular coherence tomography (OCT), which showed a splitting of the retinal neurosensory layers, at the level of the outer plexiform layer. The charts were reviewed and patient information was collected to assess for correlating risk factors. A linear regression analysis was performed with macular schisis as the dependent variable.

**Results** 6 patients were male and 4 were female with a mean age of  $63.4 \pm 5.6$  years. Five patients had a remarkable ocular history, 4 of which had retina diagnoses. Of these diagnoses, 2 were retinal detachments, 1 was an epiretinal membrane, and 1 had a macular hole. All 4 patients had retinal surgery to treat the abnormalities. Visual acuity ranged from 20/30 to 20/400 with a mean of 20/60. Axial length ranged from 22.49 to 27.82 with a mean of  $24.49 \pm 1.66$  mm, keratometry had a range of 42.85 to 47.53 with a mean of  $44.58 \pm 1.67$  D, and spherical equivalent ranged from -10.25 to 0.75 with a mean of  $-3.88 \pm 3.46$  D. IOL power used ranged from 9.5 to 23.5 with a mean of  $19.0 \pm 5.1$  D. We were unable to correlate visual acuity, axial length, corneal curvature, or refractive error with an increased risk for developing macular schisis post-operatively. We suspect that intracameral cefuroxime, used in all cases, could be correlated.

**Conclusions** This study describes pathology that is seen in x-linked disorders and high myopes, however there are no cases reported in the literature describing its occurrence after cataract extraction. We hope that our study will highlight the importance of this vision-threatening pathology and urge surgeons to examine their surgical technique, should they encounter it.

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Paper #7

Atypical antipsychotic use and the risk of cataracts

Kaivon Pakzad-Vaezi, Mahyar Etminan, Frederick S. Mikelberg

**Purpose** At our institution, requests for consultation are occasionally received to assess cataract occurrence and risk associated with systemic medications. This study was conducted to investigate cataract risk associated with the use of atypical antipsychotics.

**Study Design** Nested case-control study.

**Methods** A large health claims database (The British Columbia Linked Health Database) from British Columbia, Canada was used. Cases were defined as those newly diagnosed with cataracts defined as the first cataract procedure performed. For each case, four controls were randomly selected using a density based sampling approach and matched to the cases by age and calendar time. Rate ratios were calculated for users of atypical and typical antipsychotics adjusting for possible confounding variables, such as steroid use, uveitis, and others.

**Results** 162,501 cases of cataract surgery and 650,004 controls were included. The adjusted rate ratio (aRR) for current users of atypical antipsychotics was 0.84 (95% CI, 0.80-0.89) compared to none users. A greater number of prescriptions filled in the year prior to cataract surgery, compared to the median number of filled prescriptions, was associated with lower clinically significant cataract risk (aRR, 0.74; 95% CI, 0.69-0.80) than those with fewer prescriptions filled (aRR, 0.92; 95% CI, 0.85-0.99).

**Conclusions** A possible protective effect of atypical antipsychotic use for risk of clinically significant cataracts was established. Potential mechanisms for this protective effect will be discussed.

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Paper #8

Inhibition of Pharmacologic Mydriasis by  $\alpha$ 1-adrenoreceptor Antagonist

Jerry Leung, Amirali Azimzadeh, Lenny Radomski, Sidney Radomski, Wai-Ching Lam

**Purpose** Tamsulosin is an alpha1-adrenoreceptor antagonist used in the treatment for lower urinary tract symptoms due to benign prostatic hyperplasia. It has been associated with Intraoperative Floppy Iris Syndrome (IFIS) in cataract surgery. Our aim was to assess eye changes over time using OCT imaging of men starting Tamsulosin. This includes pupil size, pupil size change between pre- and post dilation, iris thickness, and anterior chamber depth.

**Study Design** Nonrandomized trial - interrupted time series design

**Methods** The study was carried out on 3 patients (6 eyes, men aged 66-70) with BPH and naïve to Tamsulosin usage. Anterior segment OCT images of participants' eyes were taken at 3 different points in time: Step 1-before any Tamsulosin usage, Step 2-after taking Tamsulosin for one month, Step 3-after discontinuing Tamsulosin usage for one month immediately after step 2. Measurements were made by OCT Visante software before and after dilation of each eye with Diphenyl-T. Numerical inputs for a Wilcoxon paired signed rank test for statistical significance ( $P<0.05$ ) were paired value differences between steps.

**Results** For pre-dilation pupillary diameters between 1st and 2nd step, 1st and 3rd step, 2nd and 3rd step: there are mean differences of  $-0.50 \pm 0.42\text{mm}$ ,  $-0.32 \pm 0.62\text{mm}$ ,  $+0.18 \pm 0.61\text{mm}$ ; respectively, but only the pupil size reduction between 1st and 2nd step was significant ( $P<0.05$ ). Similarly, for post-dilation pupillary diameters:  $-0.40 \pm 0.60\text{mm}$ ,  $+0.22 \pm 0.48\text{mm}$ ,  $+0.62 \pm 0.56\text{mm}$ ; but only the pupil size increase between 2nd and 3rd step was significant ( $P<0.05$ ). Average pupil size increase with dilation at steps 1, 2, 3; respectively:  $+2.14 \pm 0.60\text{mm}$ ,  $+2.24 \pm 0.85\text{mm}$ ,  $+2.68 \pm 0.60\text{mm}$ .

Post dilation iris thickness was significantly decreased from step1 to 3 at a change of  $-0.06 \pm 0.04\text{mm}$ .

Anterior chamber thickness did not significantly change at any point.

**Conclusions** Compared to baseline before Tamsulosin usage, one month usage of the drug resulted in decreased pre- and post-dilation pupillary diameters as consistent in other studies of users of more than 1 year. This is likely due to biochemical competitive antagonism at the iris dilator muscle instead of atrophy. The biochemical effect of Tamsulosin had faded as pupil sizes after one month of discontinuation were not significantly different than baseline. Pupillary dilation changes with Diphenyl-T were not found to be affected by Tamsulosin. Iris thickness was significantly decreased after discontinuation of Tamsulosin compared to baseline for

unknown reasons other than atrophy which may include constriction of iris vasculature. A larger sample size is needed for further investigation of these findings.

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Paper #9

Open globe injuries and their surgical outcomes in Saskatoon: a retrospective epidemiological study

Cornelis de Jager, Gabriela Campos, Konrad Chmiel, Matthew Regan, Vikas Sharma

**Purpose** To report on the epidemiology of open globe injuries (OGIs) and their surgical outcomes in the Saskatoon Health Region over a 10 year period.

**Study Design** Retrospective chart review.

**Methods** Methods: A retrospective chart review of 54 patients who underwent surgical repair for open globe injuries at Saskatoon City Hospital between 2000 and 2010. Type and anatomic location of injury, duration of surgery, patient demographics, surgical outcomes characterized by best corrected visual acuity (BCVA), endophthalmitis and enucleation were examined.

**Results** 46 patients were male and 8 female. 61.1% of patients had penetrating injuries compared to 38.9% blunt trauma. The average duration of surgery for penetrating trauma was 91 minutes compared to 83 minutes for blunt trauma. Post-operative BCVA was count fingers (CF) or better in 66.7% of penetrating injuries and 24.8% for blunt injuries. Corneo-scleral lacerations were the most common at 35.2%, while isolated corneal and scleral lacerations represented 33.3% and 31.5% respectively. Average surgical time was 99.7 minutes for scleral lacerations, 94.7 minutes for corneoscleral lacerations and 64.9 minutes for corneal lacerations. BCVA was CF or better in 72.2% of corneal lacerations, 36.8 % of corneo-scleral lacerations and 35.3 % for scleral lacerations. Children younger than 18 years old made up 22% of the sample size and had postoperative BCVA of CF or better in 72.8% of cases. Average duration of surgery for <18 years old was 71.1 minutes compared to 88.6 minutes for those 18 and older. 16% of patients had enucleation and 7% of all patients developed endophthalmitis.

**Conclusions** This study demonstrated OGIs are more common in males and were more often penetrating in nature. Penetrating trauma resulted in better visual outcomes. On average, surgical duration was less in penetrating compared to blunt trauma and was also generally less in patients younger than 18. Isolated scleral injuries demonstrated the longest surgical times and also had the worst visual outcomes. Factors that influence better visual outcomes include younger age and injuries confined to the cornea.

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Paper #10

What are the aetiologies, prognosis and management of childhood corneal anaesthesia?

Rosemary G. Lambley, Naira Pereyra, Kamiar Mireskandari, Asim Ali

**Purpose** Corneal anaesthesia (CA) in childhood carries a poor prognosis and there is little literature regarding its best management. We present the largest series, to our knowledge, of children with CA.

**Study Design** Retrospective chart review.

**Methods** We performed a retrospective chart review of children with congenital or acquired CA presenting over the last fifteen years. Patients with concurrent facial nerve or other cranial nerve palsies were included. Data regarding diagnosis, visual acuity, complications and surgical and non-surgical treatments over the duration of follow-up were recorded.

**Results** Twenty-one eyes of 16 children were identified with CA caused by posterior fossa tumours (5), cerebellar hypoplasia (3), severe head trauma (3), familial dysautonomia (2) and isolated CA (3). The range of follow-up was 1-244 months with a median of 47.5 months. Six eyes in four children had visual acuities (VA) of 20/40 or better. All eyes with VA 20/200 or worse at last follow-up had associated facial nerve palsy (CNVIIP) or isolated CA. Complications included corneal scarring (81%), infectious keratitis (48%), corneal neovascularisation (48%) and perforation. Two corneas with keratitis perforated (9.5%). Four children underwent corneal grafting for perforation or scarring. All grafts became scarred by final follow-up.

The commonest surgical procedure was tarsorrhaphy. Most were done when the child already had VA of 20/200 or worse. Those who had tarsorrhaphies with VA better than 20/200 maintained vision of at least 20/200.

**Conclusions** Isolated CA, and CA with CNVIIP are associated with visual outcomes below 20/200. Earlier tarsorrhaphy may help preserve vision in these high-risk eyes. We recommend that ophthalmologists suspect and test for CA in children with painless epithelial defects and consider early tarsorrhaphy.

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Paper #11

Cytoprotective effect of lacritin on human corneal epithelial cells exposed to benzalkonium chloride

Mary M. Feng, Julia Baryla, Hong Liu, Gordon Laurie, Robert McKown, Negin Ashki, Dinesh Bhayana, Cindy M. Hutnik

**Purpose** Benzalkonium chloride (BAK) is the most commonly found preservative in eye drops, and has been shown to cause ocular surface inflammation and toxicity. Lacritin is a human tear glycoprotein secreted from the lacrimal glands that has been found to be cytoprotective. This study was designed to determine if the prosecretory and mitogenic properties of lacritin confer protection to a cultured human corneal epithelial (HCE) cell line, CRL-11515, and primary HCE cells after exposure to the ocular preservative agent BAK.

**Study Design** Basic science

**Methods** Recombinant human lacritin and negative control fragment C-25 were cloned into intein fusion vectors, expressed in *E. coli*, and purified on chitin beads and DEAE Sepharose. Metabolic curves were established after exposure of subconfluent CRL-11515 cells to BAK or lacritin. Western blot analysis of lipidated LC3 (LC3-II) provided a measure of autophagy in CRL-11515 cells exposed to lacritin and/or BAK.

**Results** BAK reduced CRL-11515 cellular metabolic activity in a time and dose dependent manner. BAK-induced cellular stress was evident by elevated autophagy that increased with rising concentrations of BAK compared to control ( $P < 0.05$ ). Lacritin increased HCE cell proliferation at an optimal dose of 1 nM. Preconditioning HCE cells with 1 nM lacritin for 24 hours prior to BAK exposure significantly dampened levels of LC3-II ( $P < 0.05$ ) and promoted a 12% increase in cellular metabolic activity ( $P < 0.01$ ) when compared to BAK alone.

**Conclusions** These results suggest lacritin protects cultured HCE cells stressed with BAK and it may have the potential to be used as a topical adjunctive therapy in eyes chronically exposed to BAK.

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### Paper #12

Intraoperative pachymetric measurements with use of hypotonic riboflavin solution to maintain corneal thickness during corneal collagen cross-linking procedure.

Gabriela Campos, Sundeep Uppal, Vikas Sharma

**Purpose** To highlight the use of intraoperative ultrasound pachymetry and hypotonic riboflavin solution throughout corneal collagen cross-linking to prevent endothelial toxicity.

**Study Design** Retrospective chart review

**Methods** Charts of 11 patients (12 eyes) which had undergone riboflavin-UVA-induced corneal collagen cross-linking over the period of one year were reviewed. 8 patients (9 eyes) had progressive keratoconus while 4 patients (4 eyes) had post-lasik ectasia. The median age of these patients was 34.5.

After removal of the epithelium, central corneal thickness (CCT) was measured using ultrasound pachymetry. If CCT was found to be below 400 $\mu$ m, 0.1% Riboflavin with 20% Dextran was applied for 2 minutes every 20 minutes. Afterwards, 0.1% Riboflavin with 20% Dextran was alternated with hypotonic riboflavin drops for an additional 10 minutes. If the CCT remained below 400 $\mu$ m, hypotonic drops were applied until CCT was 400 $\mu$ m. If the CCT was the recommended 400  $\mu$ m, standard protocol was followed.

Once the CCT reached 400 $\mu$ m, the cross-linking procedure continued with UVA irradiation. After 15 minutes of UVA the CCT was again measured. If the thickness was found to have fallen below 400 $\mu$ m, hypotonic drops were again used to achieve 400 $\mu$ m CCT. At the end of 30 minutes of UVA irradiation the central corneal thickness was again measured in order to assess how the CCT had been affected by application of the hypotonic solution.

**Results** The average decrease in central corneal thickness from removal of the epithelium until after riboflavin was 50.8 $\mu$ m. The average decrease post riboflavin until 15 minutes of UVA irradiation was 59.3 $\mu$ m. From the midpoint measurement until the end of the UVA irradiation, the average decrease in CCT was 21.3 $\mu$ m.

At the 15-minute measurement of CCT, 4/12 eyes had CCT < 350 $\mu$ m. After the procedure only one patient had CCT < 350 $\mu$ m.

**Conclusions** Intraoperative pachymetry measurements along with hypotonic solution to identify and counteract decreased CCT, identified midway through 30 minute corneal cross-linking procedures, may be beneficial in preventing corneal endothelium toxicity if it allows the maintenance of a corneal thickness of > 350 $\mu$ m throughout the duration of UVA irradiation.

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Paper #13

Photorefractive keratectomy after deep anterior lamellar keratoplasty

Pichaporn Artornsombudh, Yakov Goldich, Noa Avni-Zauberman, Setareh Ziai, Uri Elbaz, David Rootman

**Purpose** To report the efficacy and safety of photorefractive keratectomy (PRK) for the treatment of residual refractive error following deep anterior lamellar keratoplasty (DALK).

**Study Design** Retrospective case series

**Methods** All patients that had PRK for residual myopia, hyperopia and astigmatism following DALK between January 2008 to October 2012 were included in this study. Mitomycin C (MMC) was applied in all cases. The uncorrected distance visual acuity (UDVA), corrected distance visual acuity (CDVA), manifest refraction, corneal topography, early and late complications were assessed.

**Results** The study included 13 eyes of 13 patients. Nine patients were male and four patients were female. Mean age was  $41.3 \pm 18.4$  years (Mean  $\pm$  SD). The indications for DALK were: keratoconus (7 eyes), post-infectious scar (4 eyes), post-laser scar (1 eye), and post radial keratotomy (1 eye). Six patients were intralase enabled DALK (IE-DALK). The mean period between the DALK and PRK was  $27.4 \pm 12.7$  months. The preoperative UDVA was  $0.88 \pm 0.53$  logMAR. The preoperative mean CDVA was  $0.20 \pm 0.18$  logMAR and the mean spherical equivalence (SE) was  $-2.65 \pm 5.00$  diopters (D). The mean follow up after PRK was  $12.5 \pm 11.7$  months. At the final visit, the mean UDVA was improved to  $0.23 \pm 0.25$  logMAR ( $P = 0.001$ ). The mean CDVA was  $0.17 \pm 0.22$  logMAR ( $P = 0.57$ ), and the mean final SE was  $-0.05 \pm 1.41$  D ( $P = 0.069$ ). Astigmatism tended to be decreased from  $-3.27 \pm 1.76$  D preoperatively to  $-0.94 \pm 0.49$  D postoperatively ( $P=0.001$ ). Mild corneal haze was presented in 4 patients. One patient had corneal epithelial rejection at 6 months after PRK with MMC which resolved after treatment with topical steroids.

**Conclusions** Using PRK with MMC for the treatment of residual refractive error after DALK lead to improvement in uncorrected visual acuity and can be considered as an acceptable treatment modality to improve quality of vision following DALK.

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### Paper #14

Comparison of the prevalence of donor cornea tissue contamination and its association with infection following corneal transplantation versus glaucoma drainage device implantation with cornea patch graft

Christine Law, Nilay Shah, Delan Jinapriya, Robert Campbell, Stephanie Baxter

**Purpose** Many studies have investigated the low frequency of infection post corneal transplantation surgery despite a high prevalence of corneal donor tissue microbial contamination. However, the rate of infection relative to positive microbiology in donor cornea tissue post glaucoma drainage device implantation with cornea patch graft is unknown. We evaluated the prevalence of donor cornea tissue contamination, the spectrum of the contaminating microorganisms, and the effect on the prevalence of ocular infection in post corneal transplantation patients and glaucoma drainage implantation patients receiving donor cornea patch graft.

**Study Design** Retrospective chart review

**Methods** The microbiologic records of corneal donor rims submitted for culture following corneal transplantation and glaucoma drainage device surgery between January 2010 and November 2012 were reviewed. Clinical outcome measures were recorded for each patient receiving donor cornea tissue.

**Results** Of 312 donor corneal rims cultured during the study period, 33 were positive for microbial growth (10.6%). From the positive cultures 29 (87.9%) were positive for bacteria and 4 (12.1%) were positive for fungus. Staphylococci (33.3%) and propionibacterium (24.2%) were the most common isolated bacteria. All fungi cultured were Candida species. Analysis revealed the prevalence of positive results was 25 in 207 (12.1%) and 8 in 105 (7.6%) for corneal transplantation procedure (PK, DALK, DSAEK, Boston K-Pro) and glaucoma drainage device implantation patch graft, respectively. There was no significant relationship between the procedural use of donor cornea and the occurrence of positive microbiologic results ( $P=0.23$ ). The overall incidence of clinical infection was found to be 1.6% (5/312), with 80% (4/5) associated with corneal transplantation and 20% (1/5) with glaucoma drainage device implantation. There was no significant difference between the rates of infection relative to the type of procedure ( $P=0.51$ ). Of the 5 infected cases, 2 (40%) were in patients who received contaminated donor cornea; one had a corneal transplantation procedure with positive bacterial culture, while the other had patch graft for glaucoma drainage implantation with positive fungal culture.

**Conclusions** The general overall incidence of infection following use of corneal donor tissue compared to positive microbiological culture is relatively low. However, it appears the rate of post-operative infection is similar whether the donor tissue is used for corneal transplantation versus glaucoma drainage device implantation patch graft.

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Paper #15

Risk of graft failure with an intraocular pressure spike following Descemet's stripping automated endothelial keratoplasty

Michael Pace, Tony Lin, Alexander Tokarewicz

Purpose Descemet's Stripping Endothelial Keratoplasty (DSEK) is emerging as the treatment of choice for corneal endothelial dysfunction. DSEK demonstrates favourable outcomes as compared to Penetrating Keratoplasty (PK) as a method for corneal endothelial transplantation; however, the relatively recent development and use of DSEK means a paucity of research on long-term outcomes and risk factors for graft failure. The well-established literature of risk factors for graft failure in PK demonstrates that an acute post operative increase in intraocular pressure (IOP) increases the risk of graft failure. As we have observed patients with a post DSEK rise in IOP we were interested to see if this correlated with graft failure. Preliminary reports on DSEK indicate that an acute post-operative rise in IOP does not appear to influence graft survival; however, this warrants further study.

Study Design Retrospective case review.

Methods In this study, 30 DESK cases performed at the Ivey Eye Institute were retrospectively reviewed. This study was conducted in accordance with the Declaration of Helsinki and Western University's Health Sciences Research Ethics Board. Only the first graft received by each patient was analyzed. Corneal graft failure was defined as an irreversible loss of optical clarity. Graft survival was calculated using Kaplan-Meier survival analysis. Post operative rise in IOP (>21mmHg), the indication for DSEK, and concurrent IOL surgery were analyzed as potential risk factors for graft failure by Cox proportional hazards analysis.

Results Overall graft survival was 70% with all graft failures occurring within the first year. Graft survival in eyes with and without a post operative rise in IOP were 83.3% and 66.7% respectively ( $P>0.05$ ). Indication for DSEK and concurrent IOL surgery were not significant risk factors for graft failure in Cox proportional hazards analysis.

Conclusions Patients with a medically managed rise in IOP following DSEK were not at significantly higher risk for graft failure. Although post operative IOP rise should be treated appropriately, it does not appear to be a predictor of graft failure in DSEK. This study adds to the growing body of literature demonstrating that a post operative rise in IOP is not a risk factor for graft failure in DESK.

The authors have no funding or conflicts of interest to disclose.

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Paper #16

Characteristics of patients with ocular cicatricial pemphigoid referred to the major tertiary hospital.

Yakov Goldich, Setareh Ziai, Pichaporn Artornsombudh, Noa Avni-Zauberman, Uri Elbaz, Clara C. Chan, David Rootman

**Purpose** Ocular cicatricial pemphigoid (OCP) is an immune mediated potentially blinding disease. The final diagnosis is often delayed and performed only in a specialist clinic and the timely referral couldn't be overemphasized. The aim of this retrospective study is to describe demographic and clinical characteristics of patients who were referred to Toronto Western Hospital for OCP assessment.

**Study Design** Retrospective clinical study

**Methods** Retrospective analysis of patients' data was performed. Patients characteristics as well as diagnosis methods, disease staging, progression, ocular and systemic involvements were analyzed.

**Results** Twenty eight patients (21 Females, 7 Males; 54 eyes ) were assessed. The mean age at presentation was 71.2 years. Staging was performed using Foster's staging system. At presentation the proportions were: Stage I - 9.2%, stage II - 20%, stage III- 64.8%, stage IV- 5.5%. At last visit the proportions of the involved eyes for stages I to IV were 1.8%, 9.2%, 74% and 14.8%, respectively.

Mean follow up was 6.8 years. Biopsies were performed in 75% of the patients (positive 19%, negative 71%, inconclusive 9.5%).

**Conclusions** Despite being followed and treated in a tertiary care hospital in the majority of patients progression of the disease were noted. High negative biopsy rate suggests using additional modalities for confirming OCP diagnosis in clinically suspected patients.

Cornea- Posters

Saturday 15 June

Paper #17

**SAFETY AND EFFICACY OF A NEW APPROVED, CORNEAL CROSSLINKING (CXL) PROTOCOL**

Jamie Bhamra, Azien Safarpour, Lisa Cuschieri

**Purpose** To evaluate the safety and efficacy of a new corneal crosslinking protocol for keratoconus and keratectasia

**Study Design** Retrospective, case control

**Methods** A new UV light source and approved CXL protocol is evaluated. A retrospective case control study format is used to evaluate eyes with keratoconus, pellucid degeneration or post-refractive surgery ectasia that underwent the new CXL protocol. The new protocol involved exposing the cornea to UV-A light for 10 min instead of 30 min (old CXL protocol) while instilling riboflavin drops every 2 minutes, instead of every 3 minutes (old CXL protocol). Pre-procedure work up and post-procedure examinations were similar. Follow-up visits were carried out at 1 day, 1 week and 1 month on all patients. Post-op evaluation included: visual acuity, slit lamp evaluation, applanation tonometry, pachymetry and pentacam imaging (not performed at 1 day visit).

**Results** This study evaluated 40 eyes of 28 patients undergoing new CXL protocol. 100% of patients completed the 1-month post procedure follow-up at the time of this abstract. 16 patients were male (57%) and patients ranged in age from 17 - 54 years. 1 eye of 40 developed a sterile infiltrate at 1-week post procedure. 42% of Km readings were greater than 1.00 D over the preoperative value at 1 month, following trends in the current literature.

**Conclusions** The new technique of CXL is safe and efficacy is similar when compared to control using the old CXL protocol. In a study by Hersh et al. 2011, both corrected distance visual acuities and maximum keratometry values worsened between baseline and at 1 month. Our study is phase 1 of a larger, comparative, longitudinal study (phase 2). Our goal is to evaluate the results over 1 - 2 years after (phase 2 study) utilizing our newer CXL technique in comparison to our older CXL protocol.

Cornea- Posters

Saturday 15 June

Paper #18

Association between Fuchs's Corneal Dystrophy and a Single Nucleotide Polymorphism on Chromosome 18 in Mexican Population.

Erika P. Lopez, Francesc March

**Purpose** To determine the association of risk alleles of the single nucleotide polymorphism that has been most highly associated with the presentation of Fuchs's Corneal Dystrophy, rs613872 in Intron 3 of TCF4 , in Mexican Population.

**Study Design** Case control study

**Methods** A case control study was made. We recruited 20 subjects of Mexican Population with the diagnosis of Fuchs's Corneal Dystrophy. Subjects were considered with this diagnosis if the clinical description of the corneal was consistent with grade 1 guttae or higher on a published scale. All subjects were of Mexican descent. All subjects provided written informed consent. We genotyped the single nucleotide polymorphism rs613872 in Intron 3 of TCF4 and confirmed the association with the disease.

**Results** Three patients presented the polymorphism. None of the patients of the control group presented the polymorphism.

**Conclusions** The polymorphism rs613872 in Intron 3 of TCF4 has been reported to be the most highly associated SNP in patients of European descent. This polymorphism was present in 15% of the patients with the diagnosis of FED, this suggests that in Mexican population other polymorphisms must be associated with the presentation of this disease, but the fact that none of the patients of the control group presented the polymorphism suggests that this could be confirmed in a bigger sample of population of the same descent

Cornea- Posters

Saturday 15 June

Paper #19

Fibrin glue instead of sutures in Gundersen Flap surgery.

Marc Wallace, Lorne D. Bellan

**Purpose** To report a case of painful band keratopathy in a blind eye that was treated with a modified Gundersen Flap procedure using fibrin glue instead of sutures for closure.

**Study Design** Case report.

**Methods** An 83 year old female had extensive band keratopathy and the remaining corneal epithelium debrided under topical anesthesia. The superior conjunctiva up to the fornix was undermined and brought down to cover the entire cornea as a bridge flap. Fibrin sealant was used to glue this to cornea and the edge of the lower conjunctiva.

**Results** Postoperatively the patient was pain-free. At one week and three months slit lamp biomicroscopy confirmed the conjunctival flap completely covered the cornea.

**Conclusions** Attachment of the Gundersen Flap with fibrin glue may offer advantages over the use of sutures, including minimizing postoperative patient discomfort.

Cornea- Posters

Saturday 15 June

Paper #20

The Effects of Amniotic Membrane Extract on Primary Human Corneal Epithelial Cells.

David V. Dudok, Kevin Cheung, Hong Liu, Sunil Parapuram, Cindy M. Hutnik

**Purpose** To assess the effects of amniotic membrane extract (AMX) on the cellular activity of primary human corneal epithelial (HCE) cells.

**Study Design** To assess the effects of AMX on corneal epithelial cellular activity under mechanical and oxidative stressor conditions.

**Methods** A lyophilized form of amniotic membrane known as AMX was obtained from Keera Inc. The lyophilized form was reconstituted in balanced salt solution. Primary human corneal epithelial cells were cultured. MTT assay for cellular viability over 48 hours using various AMX concentrations was carried out with 10% fetal bovine serum and serum-free media as controls. The second phase involved mechanical stress of HCE culture simulating a corneal injury. 0.34 mm pipette end made a linear scratch in the HCE culture. 0.1% AMX was incubated for 48 and 72 hours in culture and comparison of scratch healing was made versus serum-free control. The oxidative phase involved use of 0.5 mM tertiary-butylhydroperoxide (t-BOOH) addition to HCE culture for 1 hour, washout of cells, then addition of 0.1% AMX versus control for 48 hours. Cell viability assessed through MTT assay. Further study was undertaken using 12 hour pre-treatment with 0.1% AMX before repetition of the oxidative protocol.

**Results** MTT assay for cellular viability in percentages were 100% for control, 101% for 0.01% AMX, 95.5% for 0.05% AMX, 95.3% for 0.1% AMX, 78.5% for 0.5% AMX, 72% for 1% AMX, 44% for 5% AMX, and 91% for 10% fetal bovine serum. Based on the percentages, 0.1% AMX was chosen for further study due to highest viability for highest concentration. Mechanical "scratch" test on the HCE cultures revealed a statistically significant distance ratio at 48 and 72 hours in favour of 0.1% AMX treated cultures ( $p = 0.021$  and  $0.035$  respectively). Oxidative stress with 0.5 mM t-BOOH 1 hour administration did not reveal any significant difference in MTT assay of AMX treated versus control cultures (71% vs. 69%). The pretreatment with 0.1% AMX for 12 hours before repeat of t-BOOH protocol revealed a significant difference at 24 hours (73% AMX vs. 66% control,  $p=0.04$ ) but not at 48 hours (81% AMX vs. 71% control,  $p=0.38$ ).

**Conclusions** The concentration of AMX with the best cellular viability in relation to highest concentration seemed to be 0.1%. The 0.1% AMX treated cells healed faster with a mechanical insult compared to controls which would suggest its benefit in an acute corneal injury. AMX assisted the cellular proliferation of the HCE cultures. The oxidative impact on cellular viability of t-BOOH was not significantly improved with 0.1% AMX administration vs. control unless the cells were pre-treated with AMX. In more chronic corneal stress, AMX pre-treatment may

provide some benefit.

Cornea- Posters

Saturday 15 June

Paper #72

Comparison of corneal optical coherence tomography, optical pachymetry, and ultrasonic pachymetry in patients undergoing corneal collagen crosslinking for keratoconus

Bruce Nichols, Lulu Bursztyn, Kulbir Gill

**Purpose** Corneal collagen cross linking (CXL) is a procedure used to reduce the progression of corneal ectasia in patients with a diagnosis of keratoconus. In order to evaluate and understand the possible mechanisms of corneal changes in the treatment paradigm of CXL, we examine the changes in central corneal thickness (CCT) from pre op to post op in this subset of patients. We compare three different instruments (Optical Coherence Tomography, Optical Pachymetry, and Ultrasonic Pachymetry) when examining patients for central corneal thickness (CCT) changes following corneal cross linking (CXL) for keratoconus and record variation of these measurements by device.

**Study Design** This was a prospective, non randomized, single center study. This study was approved by the Health Science Research Ethics Board (HSREB) Delegated review – Level 2, Western University. REB approval was obtained June 19, 2012.

**Methods** A total of 16 patients have enrolled into the study. All patients underwent CXL for a diagnosis of keratoconus. Based on the patient's central corneal steepness, patients received either CXL or a combination of CXL with INTACS (when the Kmax >60 diopters CXL and INTACS was preformed).

Patients' pachymetry readings were measured by three different instruments: ultrasound ( Sonomed Corneo-Gauge Plus), optical ( Oculus Pentacam ), and OCT ( OptoVue, iVue) to assess their central corneal thickness (CCT) preoperatively. Patients were evaluated and the tests were performed post operatively at 1 month, 3 months and 6 months with all three instruments. **Results:** All instruments showed an average decrease in CCT. At one month post CXL the values were: ultrasound 1.2% reduction, Pentacam 0.6% reduction, OCT 2.7% reduction. Correlation value in CCT after one month post CXL in Ultrasound vs. Pentacam was 0.89, Ultrasound vs. OCT was 0.86 and Pentacam vs. OCT was 0.86. Results for the 3 and 6 month follow-ups will be presented.

**Conclusions** Results show an initial decline in CCT at one-month post CXL with all three measurement devices and this confirms previous studies. It is theorized that CXL results in tissue compression leading to increased biomechanical strength at the molecular level. The different testing modalities each have their own unique characteristics.

## Glaucoma- Posters

Saturday 15 June

### Paper #21

#### Tele-glaucoma clinical outcomes and referral pathway

Sanam Verma, Sourabh Arora, Faazil Kassam, Marianne Edwards, Karim F. Damji

**Purpose** To review the diagnostic outcomes and clinical referral pathways of patients assessed and managed through a collaborative care remote tele-glaucoma program.

**Study Design** Retrospective cohort study.

**Methods** We examined the data of 247 patients referred to the program from 2008-2012. Eligible patients were those assessed by the referring optometrist or ophthalmologist to be open angle glaucoma suspects, or have definite early open angle glaucoma. Patients were excluded if they had one or more of the following: angle closure, secondary glaucoma, hyperopia > +6D, IOP > 35 mm Hg, advanced glaucoma, or anxiety. The consult (referral letter, standardized protocol for history, exam, and stereoscopic optic nerve photographs, visual fields, and when available ancillary testing such as OCT and HRT) was sent virtually via secure proprietary software (Secure Diagnostic Imaging Inc.). A glaucoma specialist analyzed data and provided a diagnosis of 'suspect', 'definite', or 'unaffected' with respect to glaucoma status. Clinical referral pathways were noted: in-person consultation with glaucoma specialist, repeat teleconsultation, glaucoma collaborative management with optometrist, or referral for a non-glaucoma concern. Time-to-referral and time-to-follow up recommendations were measured.

**Results** Of all tele-consults, 31% were diagnosed with glaucoma, 42% were suspects, and 27% were unaffected. 31% of all patients were referred for in-person evaluation to a glaucoma specialist or comprehensive ophthalmologist of whom 87% were seen for glaucoma management and 13% were referred for non-glaucoma concerns. Treatment was initiated prior to being seen for 87% of definite glaucoma patients and 28% of glaucoma suspects. Referral to a glaucoma specialist (68% of those seen in-person) took 8.6 +/-3.2 weeks, while referral to a comprehensive ophthalmologist took 10+/-2.6 weeks. For in-person referral, overall wait time for patients with a diagnosis of definite glaucoma was 7.9+/-3.2 weeks and for glaucoma suspects 10.2+/-2.8 weeks. Time taken for the glaucoma specialist to complete the virtual report was 6.5 +/- 6 days.

**Conclusions** Of all patients seen through the remote teleglaucoma program, which has specific eligibility criteria, most did not require an in person consultation with an ophthalmologist, and could be managed collaboratively. For the approximately one third that were diagnosed with glaucoma based on virtual assessment, medication was started in the majority of cases, and in person consultation was arranged. Further studies to validate and consider cost effectiveness of this system are underway.

**Acknowledgement:** We thank program coordinators Abshir Moalin and Samreen Ali for their support.

## Glaucoma- Posters

Saturday 15 June

### Paper #22

Quality of Referral Letters to a Tertiary Glaucoma Unit- adherence to the Canadian Ophthalmology Society Glaucoma Guidelines.

Jason Cheng, Laura Beltran Agullo, Graham E. Trope, Yvonne M. Buys

**Purpose** To assess the quality of glaucoma referral letters in relation to current Canadian guidelines

**Study Design** Prospective case note review

**Methods** Prospective review of 100 consecutive referral letters to a tertiary glaucoma unit. Letters were assessed for content, in relation to the Canadian Ophthalmological Society glaucoma guidelines, and legibility .

**Results** Out of the 100 referrals, 40 came from optometrists, 45 from ophthalmologists 12 from family physicians and 3 from other sources. The most common reason for referral was for suspected diagnosis of glaucoma (42%), assessment for progression/further treatment (22%), angle closure assessment (17%), second opinion (6%) and secondary glaucoma (IOP) (3%). Of the 42 referrals for suspected diagnosis of glaucoma, 15 were from optometrists, 19 from ophthalmologists, 8 from others. The 15 optometry referrals all provided visual acuity (VA) IOP, and disc assessment, 8 (53%) also provided visual fields (VF). In contrast, the 19 referrals from ophthalmologists provided much less frequent information on VA (53%  $p=0.002$ ), IOP (68%,  $p=0.02$ ), disc assessment (89%,  $p=0.49$ ) and VF (5%,  $p=0.004$ ). Of the 22 referrals for progression assessment or for consideration of surgery, 20 (90%) included the current IOP, 13 (59%) disc assessment, 17 (77%) current glaucoma therapy, 8 (36%) included a current VF and 4 (18%) provided previous VFs. Only 3 (14%) of these referrals included more than 10 of the 14 suggested information points in the Canadian Ophthalmological Society glaucoma guidelines, and 54% included less than 8 of the 14 points. Overall, 88% of the referral letters were deemed legible.

**Conclusions** Our study shows that glaucoma referral letters rarely contain all the relevant information and ophthalmologists are particularly at fault. 54% of glaucoma referrals from optometrists and ophthalmologists contain half or less of the suggest information recommended by the Canadian Ophthalmological Society. Over 20% of the referrals were at least partially illegible. Further education and perhaps implementation of a proforma may improve referral letter quality.

## Glaucoma- Posters

Saturday 15 June

### Paper #23

Comparison of the outcomes of Trabeculectomy with mitomycin C and Phaco-Trabeculectomy with mitomycin C

David Comstock

**Purpose** A number of studies have demonstrated safety and effectiveness of phaco-trabeculectomies. However, it is still unclear whether increased inflammation during a combined surgery may decrease the long-term intraocular pressure lowering effectiveness of trabeculectomy. We compared the success of two site phaco-trabeculectomy + MMC with trabeculectomy +MMC. Our hypothesis is that trabeculectomy is superior to phaco-trabeculectomy for pressure lowering effect. To our knowledge, this is the only study comparing two site phaco-trabeculectomy with trabeculectomy.

**Study Design** This is a retrospective chart review. Inclusion criteria: open or closed angle glaucoma, history of trabeculectomy or phaco-trabeculectomy. Exclusion criteria: age less than 40, less than 3 months follow up post-surgery, history of previous intraocular surgery other than uncomplicated cataract surgery and inflammatory or neovascular glaucoma.

**Methods** Charts of patients who satisfy the inclusion and exclusion criteria and who underwent trabeculectomy or phaco-trabeculectomy performed by Dr. Shuba between 2005 and 2010 were reviewed. Primary outcome measures: Number of patients with IOP less than 21 mm Hg or  $\geq 30\%$  reduction from the pre-operative IOP (category 1), patients with IOP  $< 21$  mm Hg (category 2) and patients with a decrease of 30% from baseline (category 3). Additional analysis: (1) complete success - number of patients with an IOP decrease of 30% from the pre-operative IOP without glaucoma medications; (2) qualified success - number of patients who achieved the goals of complete success with the addition of glaucoma medications. Fisher's Exact test and Chi square analysis was used to compare the two groups.

**Results** A total of 168 eyes were analyzed. Baseline characteristics of the two groups were similar. There was a statistically significant difference in the one month, one year and greater than 1 year follow up favoring trabeculectomy. At one month PTMMC showed 59% success and TMMC 81% success in category 1 (OR 2.7 CI 1.24-5.73), 59% vs. 75% in category 2 (OR 2.5 CI 1.2-5.2) and 38% vs. 59% in category 3 (OR 2.3 CI 1.2-6). At 1 year PTMMC showed 86% success and TMMC 94% success in category 1 (OR 2.76 CI .87-11.35). At greater than 1 year PTMMC had a 68% success rate while TMMC had 79% success (OR 2.63 CI 1.2-6). Complete success was achieved in 60 % of the TMMC patients and 40 % of the PTMMC patients at 1 month ( $p=.01$  OR 2.25 CI 1.12-4.54), 85% versus 69% ( $p=.045$  OR 2.48 CI .88-6.96) at 6 months and 70% vs. 53% ( $p=.06$  OR 2.05 CI .81-5.18) at the 1 year follow up point all favoring

TMMC.

Conclusions Trabeculectomy was superior to Phaco-trabeculectomy for IOP control at one month and greater than one year follow up. There was a higher chance of complete success with trabeculectomy. Similar post-operative complication rates were found. Separating cataract and trabeculectomy may result in a significant benefit to IOP control in glaucoma patients.

## Glaucoma- Posters

Saturday 15 June

Paper #24

Acetazolamide Induced Hemorrhagic Anuria

Sundeep Uppal, Ravikrishna Nrusimhadevara

**Purpose** To describe a rare and potentially life threatening case of hemorrhagic anuria secondary to the use of Acetazolamide to control IOP.

**Study Design** Case Report

**Methods** Chart Review

**Results** A 62 year old healthy gentleman with longstanding bilateral spontaneous dislocation of cataractous lenses into the vitreal cavity developed unilateral acute elevation of IOP to 50mmHg following an episode of treated anterior uveitis. He was started on Acetazolamide, Azarga, and Combigan. The patient underwent urgent Pars Plana Vitrectomy, Lensectomy, and Endolaser with C3F8 gas insertion for a peripheral retinal tear found incidentally in the affected eye. Post operative IOP was within normal limits and all glaucoma medications were discontinued. The patient returned in follow up at one week where IOP was measured at 45mmHg and he was restarted on Acetazolamide.

Three days later the patient returned complaining of severe abdominal pain. He had an episode of gross hematuria the night before and had not been able to urinate since. Serum Creatinine was found to be markedly elevated at 428 umol/L (normal 60-104). Foley catheterization did not produce any drainage. A presumed diagnosis of Acute Renal Failure secondary to Acetazolamide was made. The patient was urgently referred to the Nephrology service and switched to topical glaucoma drops (Combigan and Alphagan 0.15%). A renal ultrasound showed bilateral hydronephrosis and proximal hydroureter with a collapsed bladder. The patient underwent urgent bilateral nephrostomy tube insertion. The nephrostomy tubes had excellent drainage with a subsequent reduction in serum creatinine to normal values prior to discharge from hospital. IOP continued to be stable and he discontinued all glaucoma medications three weeks later.

**Conclusions** Hemorrhagic Anuria is a rare and potentially fatal complication of Acetazolamide therapy. Our literature search showed a total of three similar reported cases in patients who developed renal failure acutely after initiation of Acetazolamide with the most recent case dating to 1978.

The underlying pathophysiology in relation to Acetazolamide is poorly understood though, as a sulfonamide derivative, it could be related to ureteric calculi formation which is a known complication of sulfonamides. Despite this, the overall incidence of nephro/urologic complications of Acetazolamide remains low.

Patients typically present with severe flank pain and gross hematuria or decreased urine output. Initial laboratory testing should include electrolytes and serum creatinine. Diagnosis can be aided by renal ultrasound to reveal hydronephrosis though definitive diagnosis is through voiding cystourethrogram. Treatment is centred upon relieving the obstruction by insertion of nephrostomy tubes. Prognosis is typically favorable with prompt diagnosis and treatment. In our case, the patient's renal function returned to normal after a one week hospital admission with nephrostomy tube drainage.

## Glaucoma- Posters

Saturday 15 June

### Paper #25

Benzalkonium chloride is cytotoxic while preservative-free tafluprost is cytoprotective in human trabecular meshwork cells.

Caitlin A. Chang, Cindy M. Hutnik

**Purpose** The use of the preservative benzalkonium chloride (BAK) in topical ophthalmic medications is controversial. It is effective as an antimicrobial and antifungal compound, and is the most frequently used preservative in topical ophthalmic medications. However, as BAK adversely affects the surface of the eye and reduces patient comfort and compliance, there is interest in alternative or preservative-free formulations. Tafluprost is the first preservative-free PGA, has good tolerability and safety, and its IOP-lowering effect is comparable to that of other PGAs. Like other PGAs, it acts on the prostaglandin F<sub>2α</sub> receptor, which is known to have anti-apoptotic effects. The purpose of this study was to investigate the effect of BAK toxicity and tafluprost in primary human trabecular meshwork (HTM) cells, and to study the cytoprotective effect of tafluprost in HTM cells stressed with BAK. Our objective was to determine whether BAK or tafluprost have an in vitro cytotoxic effect on primary HTM cells, and if BAK-tafluprost co-incubation attenuates BAK cytotoxicity.

**Study Design** Basic science.

**Methods** Primary HTM cells were treated with various BAK and tafluprost free acid concentrations over multiple exposure times, and cell viability was measured with the 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenol tetrazolium bromide (MTT) assay. HTM cells were co-treated with BAK and tafluprost free acid for 30 min and cell viability was assessed.

**Results** BAK treatment induced a time- and dose-dependent reduction in HTM cell viability. Tafluprost treatment did not significantly affect cell viability. Co-treatment of BAK with tafluprost showed an increase in cell viability as compared to BAK treatment alone.

**Conclusions** These results demonstrate that BAK is harmful to the health of the HTM cells, and its use in topical ophthalmic medications should perhaps be re-evaluated. Tafluprost is both safe and cytoprotective for the HTM. The finding that tafluprost has a positive effect on HTM cell viability, with minimal or no negative effects, further supports the merits of the use of preservative-free ophthalmic medications in the treatment of glaucoma. Further clinical investigations are needed to clarify whether BAK reduces the efficacy of anti-glaucoma medications and whether tafluprost may provide additional benefits for glaucoma patients besides lowering IOP.

## Glaucoma- Posters

Saturday 15 June

### Paper #26

Elevated anticardiolipin antibodies and glaucomatous visual field progression

Caroline Gabias, Ellen E. Freeman, Renaud Duval, Mark Lesk, Paul Harasymowycz, Daniel Desjardins, Gisele Li

**Purpose** To determine the relationship between elevated anticardiolipin antibodies and glaucoma progression

**Study Design** Hospital-based case-control study. 54 cases with glaucoma progression and 58 controls without glaucoma progression

**Methods** Patients with open-angle glaucoma who had been seen in the last 2 years and who had at least 4 years of follow-up were recruited from August 2008 until September 2010 from the Glaucoma Service at Maisonneuve-Rosemont Hospital in Montreal, Canada. Cases had documented visual field progression and controls had stable or improving visual fields over the 4 year period. Blood samples were taken and enzyme-linked immunosorbent assays were used to detect and quantify IgM and IgG levels of anticardiolipin antibodies. Other data were collected from the medical record on current ocular and systemic medications and on other medical conditions.

**Results** 16% of cases and 15% of controls had a positive antibody response ( $P=0.949$ ). Adjustment for other variables like age, gender, and last intraocular pressure did not change the negative results.

**Conclusions** Anticardiolipin antibody levels were not associated with glaucoma progression in this cross-sectional study.

## Glaucoma- Posters

Saturday 15 June

### Paper #27

Trabeculectomy With Mitomycin C Associated With Sub-conjunctival Injections of Ranibizumab.

Krystyna Miskiewicz, Paul Harasymowycz, Mark Lesk, Daniel Desjardins, Cynthia Eid, Olivier Fontaine, Gisele Li

**Purpose** To evaluate the difference in outcomes of primary trabeculectomies with Mitomycin C and 2 sub-conjunctival injections of Ranibizumab versus no Ranibizumab injections .

**Study Design** Prospective randomized controlled trial

**Methods** Patients with uncontrolled glaucoma requiring a primary trabeculectomy with Mitomycin C were randomized to receive either two sub-conjunctival injections of Ranibizumab (0.5 mg/0.05 mL intra-operatively and at 14 days post-operatively) in addition to standard post-operative care (intervention group) or standard post-operative care (control group). Success was defined as a post-operative IOP between 5 and 18 mm Hg and a 20% decrease from baseline with or without hypotensive drops.

**Results** Target recruitment of (240 eyes) 240 patients has been achieved with 120 patients in each arm. Preliminary 6 month follow-up data for 120 patients has been analyzed. The proportion of patients achieving success in the intervention group was 45/75 (60.0%) compared to 40/65 (61.5%) in the control group. In the control group, 53 injections of 5-FU were performed in 35 patients compared to 39 injections in 30 eyes in the intervention group. No major complications occurred in either group.

**Conclusions** Preliminary analysis shows no difference in IOP outcomes, however, there may be fewer 5-FU injections necessary when Ranibizumab is used. More up-to-date analyses is pending.

## Glaucoma- Posters

Saturday 15 June

### Paper #28

The relationship between socio-demographic factors and non-persistence with topical glaucoma medications

Victoria Leung, Yaping Jin, Wendy Hatch, Graham E. Trope, Yvonne M. Buys, William Macrae

**Purpose** To investigate the relationship between socio-demographic factors and non-persistence with topical glaucoma medications.

**Study Design** Cross-sectional study.

**Methods** Patients on topical medical therapy for glaucoma or suspect glaucoma, who were attending the Yorkville Eye Clinic for scheduled glaucoma visits, were recruited weekly between November 2011 and April 2012. Study participants completed a socio-demographic information questionnaire. Pharmacy records of dates and quantities of glaucoma medications dispensed in the last year were obtained. From these records, cumulative numbers of gaps and days off therapy were calculated. Non-persistence was defined as having  $\geq 1$  gap in therapy. Based on expert consensus (G. Trope, MB, PhD, FRCSC; Y. Buys, MD, FRCSC, oral communication, Dec. 2011), a gap was considered to be  $\geq 14$  days without medication. Differences in persistence between socio-demographic groups were statistically tested with Chi squared or Fisher's Exact test. Differences in median numbers of days off therapy were statistically tested with the Wilcoxon test. The prevalence ratio (PR) and 95% confidence interval (CI), derived from log Poisson regression analysis, were used to assess the association between socio-demographic factors and the risk of non-persistence.

**Results** A total of 61 patients were eligible for analysis with a response rate of 95% (74/78). The median age of study participants was 72; the median time since diagnosis was 7 years; 61% were male and 71% were on a monotherapeutic medication regimen. In total, 54% of patients (n=33) were non-persistent with their glaucoma medications in the last year. Median numbers of gaps and days off therapy were 1 and 52, respectively. Self-reported, below average income was associated with approximately 2 times higher likelihood of non-persistence (PR 1.92, 95% CI 1.33-2.78,  $p < 0.01$ ). It was also marginally significantly associated with a greater median number of days off therapy ( $p = 0.07$ ). Furthermore, not having basic needs met by monthly family income was marginally significantly associated with non-persistence ( $p = 0.06$ ). Non-persistence was greater for individuals who were: diagnosed  $\leq 1$  year ago ( $p = 0.21$ ); not married ( $p = 0.47$ ); not Caucasian ( $p = 0.76$ ); not born in Canada ( $p = 0.47$ ); did not have English as a first language ( $p = 0.20$ ); and had moderate/severe glaucoma according to Harvey Visual Field testing ( $p = 0.50$ ). These differences were not statistically significant. Approximately 82% of participants indicated

that they obtained refills when existing medications were nearly depleted.

**Conclusions** Over half the study population was non-persistent. Below average income was significantly associated with objectively measured non-persistence. Socio-economic barriers to medication persistence seem to exist, and may interfere with long-term glaucoma management.

## Glaucoma- Posters

Saturday 15 June

### Paper #29

Outcome of viscodilation and tensioning of Schlemm's canal for uveitic glaucoma.

Evan Kalin-Hajdu, Karim Hammamji, Sebastien Gagne, Paul Harasymowycz

**Purpose** To evaluate the safety and efficacy of circumferential viscodilation and tensioning of Schlemm's canal (canaloplasty) in the treatment of uveitic glaucoma (UG).

**Study Design** Retrospective, non-comparative, case series.

**Methods** Canaloplasty was performed on 19 UG eyes without previous glaucoma surgery. Uveitis was controlled before and after surgery with anti-inflammatory medications.

**Results** Mean follow-up time was  $2.6 \pm 1.1$  years. Mean IOP decreased from  $28.9 \pm 8.8$  mmHg preoperatively to  $14.0 \pm 5.4$  mmHg at last follow-up ( $p < 0.001$ ). The mean number of ocular hypotensive medications decreased from  $3.7 \pm 0.8$  preoperatively to  $0.5 \pm 1.1$  at last follow-up ( $p = 0.001$ ). The percentage of complete success, qualified success, failure and complete failure eyes was 74%, 11%, 0% and 16% respectively. The following notable postoperative complications occurred: anterior chamber prolene erosion (11%), transient hyphema (11%), transient hypotony with choroidal folding (5%), prolonged hypotony with macular folding (5%) and rapid cataract progression (5%). No permanent sight reducing complications occurred. Best-corrected visual acuity decreased more than 1 line from preoperative acuity in 1 eye due to uveitis exacerbation 18 months postoperatively.

**Conclusions** This study supports canaloplasty as a durable, safe and effective primary surgical intervention in UG.

## Glaucoma- Posters

Saturday 15 June

### Paper #30

Undetected angle closure in patients referred with a diagnosis of open angle glaucoma

Sarah M. Simpson, Devesh Varma, Amandeep Rai, Iqbal Ike K. Ahmed

**Purpose** To identify the proportion of patients referred by ophthalmologists to a tertiary glaucoma center with a diagnosis of open angle glaucoma that were found to have angle closure.

**Study Design** This study is a retrospective chart review.

**Methods** We conducted a retrospective chart review of new patients referred by ophthalmologists to two glaucoma specialists in a tertiary glaucoma center between the dates of May 2009 and May 2011. Only referrals for primary open angle or pseudoexfoliative open angle glaucoma that specified angle status were included. Patients with previous cataract surgery were excluded. Chart review was performed which included glaucoma specialist's angle assessment, diagnosis, and glaucoma severity. Those with 180 degrees or more Shaffer angle grading of 0 or slit were classified as angle closure.

**Results** 122 patients had referrals with a diagnosis of glaucoma that specified open angles. Of these, 14 patients (11%) were found on examination by the glaucoma specialist to have angle closure. 29% of those that were found to have angle closure had pseudoexfoliation syndrome. There was no difference in age, gender, ethnicity, spherical equivalent, intraocular pressure, cup to disc ratio, visual field mean deviation or severity of glaucoma between patients with and without angle closure (all p-values > 0.09).

**Conclusions** 11% of patients referred by ophthalmologists to a tertiary glaucoma center with a diagnosis of open angle glaucoma were in fact found to have angle closure. Given the different treatment approaches for angle closure versus open angle glaucoma, this study suggests a need to strengthen angle evaluations.

## Glaucoma- Posters

Saturday 15 June

### Paper #31

Proportion of undetected narrow angles or angle closure in cataract surgery referrals

Stephanie Kletke, Devesh Varma, Amandeep Rai, Iqbal Ike K. Ahmed

**Purpose** To identify the proportion of patients referred for cataract surgery consultation that had undetected narrow angles (primary angle closure suspect (PACS)), primary angle closure (PAC), or primary angle closure glaucoma (PACG).

**Study Design** Retrospective chart review

**Methods** Phakic patients referred by eye care providers (optometrists and ophthalmologists) for assessment and management of cataracts only between July 1, 2010 and June 30, 2012 were identified and reviewed. Patients with pre-existing diagnoses of glaucoma, angle closure, angle closure glaucoma, or with a history of peripheral iridotomy or other glaucoma laser procedures were excluded. Demographic, referral, and specialist assessment information, as well as biometric data, including anterior segment OCT, were collected. In referrals that did not report on glaucoma or angle status, these parameters were assumed to be found normal or missed by the referring doctor.

**Results** 976 patients were included. The mean patient age was 67.0 +/- 13.2 years. 52.6% of patients were female, and 47.4% were male. Of the sample population, the proportion of underlying PACS was 9.1%, PAC was 0.4%, and PACG was 0.1%. Overall, 9.6% of patients had missed narrow angles or angle closure. Mean anterior chamber depth was 3.15 mm versus 2.72 mm ( $p < 0.001$ ) in patients with open versus narrow angles, respectively.

**Conclusions** One tenth of patients referred for cataract surgery were found to have undetected narrow angles or angle closure. Although cataract surgery may resolve narrow angles or angle closure, the results of this study imply that gonioscopy may not be adequately performed in this patient population, and possibly in general. Eye care providers should ensure accurate gonioscopy in all patients.

## Glaucoma- Posters

Saturday 15 June

Paper #32

Mirror-hat device as a drop delivery aid

Hermina Strungaru, Jonathan Peck, Emma A. Compeau, Graham E. Trope, Yvonne M. Buys

Purpose To determine whether a novel mirror-hat device, improves eye drop self administration.

Study Design Prospective observational study

Methods A mirror-hat device, consisting of a magnifying mirror attached to a brimmed cap, was provided to thirty patients with primary open-angle glaucoma or ocular hypertension, who self-administered topical antiglaucoma medication. Subjects were recruited from the Glaucoma Unit at Toronto Western Hospital. Informed consent was obtained from each patient. Drop instillation technique (time taken to instil a drop, number of drops dispensed, drop contact location and contamination of bottle tip) was evaluated with and without the device. Subjects also completed a survey regarding drop administration and satisfaction with the device.

Results Patients were less likely to contaminate the tip by touching their eye/eyelid when using the device 13.3% (4/30) than without the device 36.7% (11/30),  $p=0.02$ . Twenty six patients (86.7%) indicated they could see the drop using the device versus 12 (40%) who reported they saw the drop without the device ( $p = 0.0005$ ). Fifteen patients (50%) liked the device and reported the device helped improve eye drop instillation and delivery of the correct amount of drops without missing the eye. There were no statistically significant differences in any of the other outcomes. No predictive factors were associated with using the device including uncorrected near visual acuity, lens status and glaucoma severity.

Conclusions Use of the hat mirror device is associated with fewer eye/eyelid touch and better visualisation of the drop than without the device. This device failed to reduce time, number of drops or accuracy when administering eye drops. This device may have more utility if used when initiating treatment.

## Glaucoma- Posters

Saturday 15 June

### Paper #33

IOP-lowering and safety associated with opening Gold Micro Shunt's windows

Nicolas Cadet, Paul Harasymowycz

**Purpose** To determine the intraocular pressure-lowering effect and safety of opening the Gold Micro Shunt's (GMS) windows.

**Study Design** The study is a case series that studied 5 subjects, among which there were three with primary open-angle glaucoma, one with aphakic glaucoma and one with neovascular glaucoma. It looks retrospectively at the safety of opening the GMS' windows and its effect on the IOP and number of glaucoma eyedrops. Among the research subjects, there were 4 males and 1 female, aged between 56 and 81 (average age 70). Four of the subjects were Caucasian and one was Hispanic. They had undergone 0 to 4 surgeries before GMS implantation. The GMS has 8 closed windows upon implantation. Four of these windows were opened in all five patients. Average follow-up post GMS implantation was 3 years.

**Methods** The GMS was implanted in each patient. The IOP (using a Goldmann tonometer) and number of glaucoma medications were recorded before and after the implantation of the GMS, as well as before and after the opening of the GMS' windows with a Titanium-Sapphire (Ti-Sap) laser. Patients were assessed for complications arising from implanting the GMS and opening its windows.

**Results** Implantation of the GMS was associated with an average decrease in IOP of 26.2% ( $p=0.19$ ). The average IOP before window-opening was 24.9 and after window opening, it was 19.5. The IOP thus dropped a further 21.7% ( $p=0.055$ ) on average after the opening of the GMS' windows. The windows were opened an average 6.4 months after GMS implantation. IOP dropped 2.3 to 10.7% per window opened (average 5.3%). Long-term IOP at follow-ups remained lower than pre-GMS levels in all patients. The IOP reduction post window opening lasted throughout follow-up, i.e. from 0.5 to 42 months (average 15 months). The number of glaucoma drops for each patient did not decrease after opening the GMS' windows. One patient developed transitory cystoid macular edema after GMS implantation that resolved with a course of NSAID drops. No complication arose from the opening of the GMS' windows.

**Conclusions** Our study suggests that opening the GMS' windows is safe and is associated with a substantial and sustained reduction in IOP. In the future, conducting similar studies with larger cohorts and longer follow-up would make it possible to obtain more data.

## Glaucoma- Posters

Saturday 15 June

Paper #34

Graft-free Ahmed valve implantation through a 6 mm scleral tunnel.

Kailun Jiang, Gdih Gdih

**Purpose** To evaluate the safety, efficacy, and cost benefit to the health care system of Ahmed glaucoma valve (AGV) tube implantation through a 6mm scleral tunnel (graft-free technique).

**Study Design** Retrospective chart review (12-month follow-up) from a single clinical setting.

**Methods** Preoperative ocular medications, intraocular pressure (IOP), and visual acuity were compared to values recorded at each follow-up exam. The 95% confidence interval for fractional survival at any particular time was calculated using the Kaplan-Meier method. Failure was defined as:

1. IOP <6 mmHg or IOP > 21 mmHg on 2 consecutive visits after 3 months
2. Additional surgical intervention to control IOP
3. No light perception (NLP)

Eye banks across Canada were surveyed for cost incurred by the health care system for providing scleral tissue used in conventional AGV implantation.

**Results** 84 eyes were implanted using the graft-free method with a success rate of 89.7% at 6-month. 6 eyes failed: 3 NLP, 1 persistent hypotony, 1 secondary AVG, 1 AGV extraction. The rate of hypotony peaked at 36% on post-operative-day (POD) 1, reducing to 20% by POD10 and 1.2% by 3 months. Clinical flat anterior chamber developed in 9.5% of eyes. 10% of eyes experienced a hypertensive phase (mean IOP=27.22mmHg). Preoperatively, eyes were on average receiving 3 units of glaucoma medication. Postoperatively, 22 eyes required no medication for IOP control. Of the eyes requiring postoperative glaucoma medication, 40.5% restarted during week 3-4; an additional 23.8% of eyes were restarted 5-6 weeks post-operatively. By 6-month eyes were on average using 1.2-units of glaucoma medication. Hyphema was the most common (24%) early postoperative complication. The rate of conjunctival dehiscence within the first year is 1.2%.

4 eye banks from 4 provinces were surveyed for cost data. The cost of sclera ranged from \$116 CAD to \$300 CAD. Within our institution, excluding the cost of the valve itself, there is a 72% (\$762 CAD) cost reduction to our surgical unit with the graft-free technique as compared to the conventional scleral-graft method.

**Conclusions** Our data suggests that the safety and efficacy of a 6mm scleral tunnel is comparable to conventional scleral-graft method. The graft-free 6 mm scleral tunnel not only remove the risk of prion transmission, it simplifies and reduces procedural time and is a cost effective alternative to scleral-graft methods.

## Glaucoma- Posters

Saturday 15 June

Paper #35

Angle-closure glaucoma associated with venlafaxine (Effexor ®) treatment.

Sébastien Turcotte, Marie-Josée Fredette

**Purpose** There are few case reports linking venlafaxine treatment with angle-closure glaucoma. Information in the literature is conflicting as to the pathophysiologic mechanism of this glaucoma; one case suggested supraciliary effusion as the cause. This report aims to define the pathophysiology of a case of angle-closure glaucoma associated with venlafaxine treatment, with documentation including ultrasound biomicroscopy (UBM) and gonioscopy.

**Study Design** Case report.

**Methods** We report a case of an 86 year old patient who presented with progressive symptoms of angle-closure glaucoma in her left eye. Venlafaxine treatment had been started one week prior to presentation. Intraocular pressures were initially 22 mmHg in the right eye and 59 mmHg in the left eye. UBM and gonioscopic exams were performed to better identify the pathophysiologic mechanism of her glaucoma.

**Results** Gonioscopy demonstrated a closed angle in the left eye and a narrow angle in the right eye. There was bilateral resistance to 2% pilocarpine at presentation which subsided 72 hours after venlafaxine cessation. UBM demonstrated a plateau iris configuration with absence of supraciliary effusions.

**Conclusions** To our knowledge, this is the first case describing angle-closure glaucoma associated with venlafaxine treatment, where there is a documented bilateral resistance to pilocarpine and an UBM demonstrating a plateau iris configuration with absence of supraciliary effusions. These findings suggest a mydriatic mechanism to our patient's glaucoma. The weak anticholinergic properties and the noradrenergic and serotonergic effects associated with venlafaxine could precipitate angle-closure glaucoma without supraciliary effusions in a patient who is at risk for this condition.

## Glaucoma- Posters

Saturday 15 June

### Paper #36

The EFFECT Initiative - E-modules for foundational education and collaboration in Teleglaucoma.

Kelsey A. Roelofs, Sourabh Arora, Robert Hayward, Karim F. Damji

**Purpose** Currently there is little formal training with regard to knowledge and technical skill amongst eye care personnel involved in the teleglaucoma program. We hypothesized that a comprehensive web-based educational program could improve the quality of diagnostic information collected to support tele-consultation.

**Study Design** Educational modules (e-modules) and online community

**Methods** Objectives, knowledge, skills, protocols, and workflows relevant to teleglaucoma were rendered to storyboards that mapped efficient pathways for experiential learning. The target audience (e.g. technicians) was engaged in the selection of content and the manner of presentation. A variety of adult learning strategies were considered, with emphasis given to diversity of learners, workplace learning opportunities and effective use of learning community management systems. Online self-directed learning modules were produced supporting 2 competency targets, multiple learning styles, and extensive use of interactive online media. This involved learning interfaces such as quizzes, videos, photos with voice over explanations and links to additional references. The modules will be made available to target users through online learning communities (hosting to be determined).

**Results** Two pilot modules were created: (i) Measuring Intra-ocular pressure and (ii) Performing Gonioscopy. Each module can be experienced in a "learn" mode, where concepts and skills are taught through guided learning activities, or a "work" mode, where key resources and workplace tips are used to apply acquired knowledge in practice. Learn level objectives focus on developing a foundational knowledge base, whereas the "Work" level is aimed at helping the learner who already has a strong foundation refine their skills and troubleshoot problems encountered (for example how to calibrate Goldmann applanation tonometers). Each level of competency involves assigned readings accompanied by interactive media partitioned into 5 minute blocks and separated by knowledge and application-based multiple choice questions. Upon completion of the module, the trainee evaluates the learning material and provides feedback.

**Conclusions** E-modules have the potential to improve the quality of virtual consultations completed through teleglaucoma. This educational program can be expanded to build partnerships with underserved areas of the world.

## Glaucoma- Posters

Saturday 15 June

### Paper #37

Correlation between AS-OCT findings and IOP after Deep sclerectomy (DS) augmented with a Gold Micro-Shunt (GMS) implant in the suprachoroidal space

Elena Oxengendler, Harmanjit Singh, Paul Harasymowycz

**Purpose** To assess the correlation between AS-OCT findings and IOP lowering after deep sclerectomy with a Gold Micro-Shunt (GMS) implant in the suprachoroidal space (SCS).

**Study Design** Prospective case series

**Methods** Prospective case series of 23 eyes of 18 patients with open angle glaucoma who underwent deep sclerectomy with Mitomycin C (MMC), with a SCS implantation of GMS, with or without concomitant cataract surgery. All patients underwent AS-OCT in order to measure the area of subconjunctival filtering bleb, the area of suprachoroidal fluid, and scleral thickness. Outcome measures included correlation of the aforementioned OCT parameters and IOP at 6 months and 1 year after surgery.

**Results** Eight females and 10 males, including 13 African-Canadians and 10 Caucasians underwent DS with GMS implantation. Mean age was 64 years. 11 eyes had combined cataract surgery, 8 eyes were phakic, and 4 eyes were pseudophakic. The average mean deviation (MD) was  $-18.1 \text{ dB} \pm 10.3$ . The pre-operative average IOP was  $21.0 \pm 7.8 \text{ mmHg}$  with a mean number of  $3.0 \pm 1.6$  medications. At 6 months, the average IOP was  $14.3 \pm 4.3$  ( $p=0.0008$ ) on an average of  $1.6 \pm 1.9$  medications ( $p<0.0001$ ). At 1 year, the average IOP was  $15.6 \pm 5.2$  ( $p=0.0008$ ) on an average of  $1.6 \pm 2.1$  medications ( $p<0.0001$ ). Nine eyes (39%) underwent goniotomy. AS-OCT demonstrated no subconjunctival fluid. There was no significant correlation between the suprachoroidal fluid area and the change in IOP, however, scleral thickness ratio and change in IOP at six months and one year were significantly correlated.

**Conclusions** Deep sclerectomy with MMC, augmented with a GMS in the suprachoroidal space lowers IOP and the glaucoma medication use in patients with open angle glaucoma. No subconjunctival fluid was noted on AS-OCT. There was a correlation between IOP lowering and an increase in the scleral thickness.

## Glaucoma- Posters

Saturday 15 June

### Paper #38

Relationship of new tonometers with central corneal thickness: a comparative chart review of Goldmann Applanation Tonometry, Tonopen, Ocular Response Analyzer and PASCAL Dynamic Contour Tonometry.

Adam Muzychuk, Jaspreet Grewal, Elizabeth Oddone-Paolucci, Andrew Crichton

**Purpose** To describe the relationship between Goldmann, Tonopen, ORA and PASCAL tonometers with central corneal thickness.

**Study Design** Retrospective chart review.

**Methods** Patients of Dr. Andrew Crichton having undergone intraocular pressure measurement by three or four methods of tonometry in one clinical encounter were identified from a referral list. Demographics, past ocular history, past medical history, current medications, visual acuity, pachymetry and intraocular pressure measurements were recorded. Pearson Product Moment correlation coefficients were calculated to determine the relationship between central corneal thickness and intraocular pressure for each tonometer.

**Results** Mean IOP measurements for Goldmann, Tonopen, ORA and PASCAL were  $14.7 \pm 5.1$  mmHg (n=700),  $15.4 \pm 4.9$  mmHg (n=289),  $17.8 \pm 7.2$  mmHg (n=704) and  $18.4 \pm 5.0$  mmHg (n=700) respectively. Intraocular pressure measurements were significantly different between all devices ( $p < 0.001$ ) with the exception of Goldmann and Tonopen which were not significantly different ( $p = 0.295$ ). Pearson correlation coefficients describing the relationship between central corneal thickness and intraocular pressures were  $r = 0.25$  for Goldmann,  $r = 0.29$  for tonopen,  $r = 0.16$  for ORA and  $r = 0.17$  for PASCAL ( $P < 0.001$  for all coefficients). Moderate to strong correlations were found amongst all tonometers ( $r = 0.624 - 0.828$ ,  $p < 0.001$ ).

**Conclusions** While Goldmann and Tonopen are widely used in ophthalmology practices, new methods of intraocular pressure measurement have yet to gain traction despite the purported benefit of decreasing the influence of central corneal thickness on IOP measurement. Based on our data, all tonometers had a relatively small correlation with central corneal thickness, however the correlation was lowest for ORA and PASCAL. Although statistically significant differences were found when comparing the measurements of all devices aside from Goldmann and Tonopen, moderate to strong correlations were found amongst all tonometer measurements.

## International & Public Health Ophthalmology- Posters

Saturday 15 June

### Paper #39

Does government assistance improve access for low-income individuals to eye care providers?

Chris J. Hong, Graham E. Trope, Yvonne M. Buys, Barbara Robinson, Yaping Jin

**Purpose** To evaluate if low-income support programs facilitate access to eye care providers in Canada.

**Study Design** Cross-sectional survey.

**Methods** We systematically reviewed government-funded low-income vision care support programs in 10 Canadian provinces. We then compared utilization of eye care providers between those likely eligible for vision care assistance versus those likely not eligible using data from the Canadian Community Health Survey (CCHS) Healthy Aging 2008/09.

**Results** CCHS revealed 12.5% of Canadians aged 45-64 and 13.2% aged 65+ have difficulty meeting basic expenses (food, shelter and clothing). Individuals are eligible for vision care assistance only if they are receiving government financial assistance. The Canadian Financial Capability Survey revealed 7.9% of Canadians aged 45-64 and 5.5% aged 65+ received social assistance in 2009.

The cost of routine eye exams in Canada is not covered by government for those aged 20-64. In 4 provinces (NFLD, PEI, NB, SK) seniors are also not covered. For those receiving financial assistance the government covers maximum 70% of the eye exam cost in NB. In two provinces the government coverage is less than the average fee charged by optometrists (\$55 government vs \$65 optometrists in NFLD; \$52 government vs \$84-\$90 optometrists in PEI). Waiving the fee difference is at optometrist's discretion.

Information on eyeglasses support was available for 6 provinces (BC, MB, NS, PEI, NFLD, NB). The max government support for eyeglasses ranges from \$90-\$125 for single vision and \$110-\$179 for bifocals. In MB and NB, individual co-payment is required. Online purchase of eyeglasses is the cheapest however requires pupillary distance measurement. Government subsidies are not allowed for online purchases in BC and ON.

Among middle-aged Caucasians who self-reported not having glaucoma, cataracts, diabetes and vision problems, utilization of eye care providers was 28.2% among those reporting difficulty meeting basic expenses versus 42.0% for those without difficulty ( $p < 0.05$ ). Utilization was 25.0% for those in the lowest 10% income decile ( $p < 0.05$ ) and 22.5% for those in the 11%-20% income decile ( $p < 0.05$ ) compared to 42.1% in the 21%-100% income distribution.

When effects of age, sex and education were adjusted for, Caucasians having difficulty meeting basic needs used an eye care provider significantly less often than those without difficulty: about 30% less often for those aged 45-64 (prevalence ratio (PR) 0.68, 95% CI 0.57-0.80) and about

10% less often for seniors (PR 0.88, 95% CI 0.78-0.99).

Conclusions Despite government assistance, the poor have significantly reduced utilization of vision care.

## International & Public Health Ophthalmology- Posters

Saturday 15 June

### Paper #40

Critical review of high quality ophthalmology educational web resources targeting trainees

Milad Modabber, Sourabh Arora, Karim F. Damji, Feisal Adatia

**Purpose** There has been considerable expansion of web-based educational resources in the field of ophthalmology. The purpose of the current study was to identify, quantitatively evaluate, and to rank high quality online learning resources in ophthalmology, in order to facilitate improved selection by trainees.

**Study Design** Systematic search, validated quantitative evaluation

**Methods** A search of scientific databases (PubMed, EMBASE) and non-scientific search engines (Google.com, Metacrawler.com) was conducted to identify web-based ophthalmology resources. Academic and non-academic websites devoted to ophthalmology education and intended for medical students, residents, and fellows were included. Websites of National Ophthalmological societies were excluded. Quantitative evaluation was performed using the validated Quality Component Scoring system (QCS), assessing for: ownership, purpose, authorship, author qualification, attribution, interactivity and currency. The Technical Component Score System (TCS), which assessed for clinical content parameters was also utilized. T-test and ANOVA were conducted to compare scores on the basis of the various teaching modalities, general versus subspecialty focus, and the level of expertise.

**Results** A total of 33 websites were included for analysis. The mean score from QCS was 9.6 +/- 1.7 (maximum possible score (MPS): 13), while for TCS it was 10.6 +/-6.6 (MPS: 20), with a mean combined score of 20.2+/-6.7 (MPS: 33). The dominant teaching styles used were text/lecture-based (39%), video/multimedia (24%), case-based (21%), research articles (12%), and quiz-based (3%). However, a considerable proportion of websites (42%) utilized multiple teaching modalities. The website formats that yielded the highest mean combined scores were: text-based (22+/-7) and case-based (22+/-6), while quiz-based was the lowest (9+/-0.1). The mean TCS for ophthalmology websites targeting residents/fellows (9.2 +/- 6.7, n=25) was significantly lower than websites intended for medical students/allied health professionals (15.0+/-3.5, n=8; p= 0.004). The same trend was observed with total combined scores (19.1+/- 7.0, n=25 vs. 23.6+/-4.7, n=8) respectively (p=0.05). The mean combined score for general ophthalmology (20.5+/- 7.2, n=24) versus subspecialty websites (19.6+/-5.5, n=9) was not significantly different (p=0.71).

**Conclusions** This study has provided a quality-ranked listing of online learning resources, stratified by the learning modality, general ophthalmology vs subspecialty, and the viewers'

assumed level of training. This will allow trainees to access websites most suited to their specific needs and learning styles. The quality of current and future ophthalmological resources can be enhanced through consideration of the QCS and TCS parameters.

## Neuro-ophthalmology- Posters

Saturday 15 June

### Paper #42

What do we do to pinpoint, diagnose, treat and eradicate head front, head side and head back pains (commonly known as greater occipital neuralgia) among patients in our tertiary ophthalmology clinic? The experience of the Royal Victoria Hospital Uveitis and Ocular Immunology Tertiary Centre

Ehab Sherif

**Purpose** Cet article retrace les liens entre la névralgie du nerf grand occipital (névralgie d'Arnold ou névralgie occipitale) et ses causes oculaires. Il répond aux questions suivantes : La névralgie occipitale a-t-elle des origines oculaires? Quelles sont les caractéristiques de ces maladies oculaires? Quel est le mécanisme proposé qui lie la névralgie occipitale aux maladies oculaires? Quel est un traitement efficace et durable de la névralgie occipitale chez les patients atteints de maladies oculaires inflammatoires locales ou du glaucome?

**Study Design** Rétrospectivement, treize patients ont été référés à l'Unité d'immunologie oculaire de l'Hôpital Royal Victoria au Centre universitaire de santé McGill.

**Methods** Les treize patients comprenaient onze femmes et deux hommes. La douleur était bilatérale chez sept patients et unilatérale chez six patients. Les critères diagnostiques exigeaient : 1) la présence d'une douleur subjective tout le long du nerf grand occipital, 2) de la douleur en percutant la région occipitale des patients. Les patients ont reçu une injection intramusculaire comprenant 1 ml de triamcinolone et 2 ml de xylocaïne dans la région occipitale. Les critères des résultats se fondaient sur 1) la réduction de la douleur immédiatement après l'injection, 2) l'absence de douleur au cours des visites suivantes des patients, 3) l'absence de complications suite à l'injection.

**Results** Certains patients peuvent attendre jusqu'à cinq ans avant de recevoir le bon diagnostic en raison de la variété des types de douleur que présentent les patients. Les maladies oculaires locales les plus associées à la névralgie occipitale étaient l'uvéite chronique antérieure, l'uvéite postérieure, la sclérite, la rosacée et le glaucome. De même, la névralgie occipitale accompagnait souvent des maladies systémiques. La spondylarthrite ankylosante, l'arthrite rhumatoïde et le diabète faisaient partie des maladies les plus communément associées à la névralgie occipitale. L'injection consistant de triamcinolone et de xylocaïne s'est avérée très efficace; on a pu constater la disparition totale de la névralgie après seulement quatre injections dans certains cas. Un mécanisme neuro-vasculaire pourrait être responsable du phénomène de névralgie occipitale.

**Conclusions** La percussion du nerf occipital s'avère le moyen le plus efficace de dépister et de confirmer la névralgie occipitale. La névralgie peut se manifester longtemps après le début d'une

maladie oculaire locale de nature chronique. Elle peut également côtoyer ou annoncer le début d'une maladie systémique de nature inflammatoire.

Neuro-ophthalmology- Posters

Saturday 15 June

Paper #43

Maffucci Syndrome and Intracranial Chondrosarcomas: A Case Report Featuring Spontaneous Resolution of Sixth Nerve Palsy.

Monique Munro, Ryan Yau

**Purpose** To report a case of spontaneous resolution of a cranial nerve six palsy, prior to removal of an intracranial chondrosarcoma, occurring secondary to Maffucci Syndrome.

**Study Design** Observational case study.

**Methods** A previously diagnosed Maffucci Syndrome patient was followed in clinic after presenting with an initial complaint of lateral gaze diplopia, secondary to an intracranial chondrosarcoma.

**Results** Maffucci syndrome is a rare disease, defined by the presence of enchondromatosis with hemangiomas, and since the discovery of Maffucci syndrome in 1881, less than 200 cases have been reported in English literature to date (3). Few reports describe Maffucci syndrome from a neuro-ophthalmic approach. Here we present a sixth nerve palsy secondary to an intracranial chondrosarcoma in a 20-year-old female Maffucci Syndrome patient. She was referred to ophthalmology with a five-day history of left lateral gaze diplopia. On initial presentation, visual acuity was recorded at 20/20 OD and 20/20 OS. Orthoptics revealed a 14D left esotropia with a -2 abduction deficit OS. Visual field testing did not identify any deficits. An urgent MRI was ordered to determine the etiology and a parasellar chondrosarcoma was identified. Interestingly, after a 3-week course, this patient reported complete symptom resolution prior to any intervention. Upon examination, Visual acuity was 20/20 OU and the patient was orthophoric. Based upon a review of the literature, this report may be one of the first reporting a spontaneous resolution of gaze palsy associated with this disease.

**Conclusions** Although sixth nerve palsy has been widely documented as one of the most frequent initial findings of an intracranial lesion in association with Maffucci Syndrome, there is scant description of the course of the ocular manifestations. This case not only highlights a rare disease process that questions the process of mass effect, but also raises the issue of when is it appropriate to observe versus image young patient populations presenting with diplopia.

## Neuro-ophthalmology- Posters

Saturday 15 June

### Paper #44

Unilateral ischemic optic neuropathy due to vasculitis in a patient with an ulcerative colitis flare

Fatma Zaguia, Radwan Ajlan, Ayesha Khan

**Purpose** To present a unique case of unilateral ischemic optic neuropathy due to presumed vasculitis in a patient suffering from an ulcerative colitis (UC) flare.

**Study Design** Case report of a unique case and concurrent review of the literature.

**Methods** Case report involved a chart review of the patient's file which includes complete ophthalmic exam.

**Results** An 18-year old female, with a previous diagnosis of UC, presented in March 2009 with acute right vision loss. Right orbital pseudotumor was diagnosed and intravenous corticosteroids were started; on presentation, visual acuity in the right eye OD was light perception (LP), and in the left eye OS was 20/20. Exam was remarkable for right proptosis with limited extraocular movements and fundus exam showed right optic disc swelling with blurry margins. Despite starting treatment immediately, patient's condition continued to deteriorate and the diagnosis of central nervous system vasculitis due to UC flare was reached a few days later; this was further complicated by a left MCA stroke. Aggressive treatment with cyclophosphamide was initiated, and the patient was maintained on anticoagulants. Patient recovered from her stroke, but lost vision in her right eye (vision OD: no LP)

**Conclusions** This case illustrates concomitant visual loss associated with bowel inflammatory flare-ups. A high index of suspicion is vital to properly manage the spectrum of eye complications that can be associated with UC. Although they are rare, prompt diagnosis and initiation of appropriate treatment is crucial to control symptoms. This case further reinforces the benefit of having ophthalmic evaluations as a routine component of patients with UC.

## Neuro-ophthalmology- Posters

Saturday 15 June

### Paper #45

An acute presentation of a cavernous hemangioma of the optic nerve, optic chiasm and optic tract.

Imran Jivraj, Michael Johnson

**Purpose** Central nervous system cavernous malformations affect roughly 0.5% of the population and can occur anywhere in the brain and spinal cord. Cavernous malformations affecting the optic pathway are extremely rare. Patients with these lesions typically present with acute headaches and sudden loss of vision from chiasmal apoplexy. We present a case of sudden vision loss due to a cavernous malformation affecting the optic nerve, optic chiasm and optic tract. Only 9 similar cases have been reported in the literature.

**Study Design** Case report.

**Methods** Case report.

**Results** A 21 year-old male presented with sudden loss of vision and acute headaches. Goldmann perimetry demonstrated an incongruous left homonymous heminaopia. His CT head showed a hyperdense lesion involving the proximal right optic nerve, optic chiasm and right optic tract. An MRI brain demonstrated mixed T2 signal and enlargement of the right optic nerve, optic chiasm and right optic tract with minimal enhancement after administration of gadolinium. Pituitary function testing was within normal limits. His inflammatory and infectious work-up was negative. The patient was initially managed with intravenous steroids in hospital for one week without a change in his vision occurring. Open biopsy of the posterior aspect of the chiasm revealed a surface hemorrhage overlying a cavernous hemangioma affecting the right optic nerve, optic chiasm and right optic tract. The patient noted improvement of his vision after the biopsy.

**Conclusions** Apoplexy from cavernous malformations affecting the optic pathway is a rare cause of acute vision loss, but should be considered in the differential diagnosis of lesions that affect the optic nerve, optic chiasm and optic tract.

## Oculoplastics- Posters

Saturday 15 June

### Paper #46

Ocular Adnexal Lymphomas in a Canadian Center-A Clinicopathologic Analysis of 60 Cases.

James Farmer, Isabelle Bence-Bruckler, Manisha Lamba

**Purpose** Ocular adnexal lymphoid tumors may involve the orbit, lacrimal gland, conjunctiva and eyelids and are commonly seen by oculoplastic surgeons. We undertook this analysis to identify the frequency of malignant lymphomas by site, subtype, treatment and prognosis to assist the surgeon in the understanding of these lesions.

**Study Design** Retrospective chart review

**Methods** The 60 cases were selected from a review of all cases in the surgical pathology files of the Ottawa Hospital between 1992 and 2011. The lesions were categorized according to latest World Health Organization classification of tumors of lymphoid tissue. The clinico pathologic and immunohistochemical features were defined as well as the frequency of tumor types and treatments offered.

**Results** B cell lymphomas were the overwhelming majority (98%) of malignant lymphomas (ML) occurring in the ocular adnexae (OA). Mucosa Associated Lymphoid Tissue Lymphoma (MALTL) was the commonest subtype (38%) in the OA followed by Diffuse Large B Cell Lymphoma (DLBCL) 21% and Follicular Lymphoma (FL) (20%). Of primary lymphomas (confined to the OA site without systemic disease), MALTL was the commonest subtype (53%) with DLBCL constituting the second most frequent (15%); of the secondary lymphomas (OA involvement seen in conjunction with systemic disease), DLBCL and FL were the most common (33% each) while MALTL was seen in only 10%. The commonest site of ML was the orbit (37%), with conjunctiva (33%), lacrimal gland (28%) and eyelid (2%) in decreasing frequency. Primary lymphomas were the most common in all sites except lacrimal gland, where the majority were secondary lymphomas (70%). Treatment for primary ML consists largely of local radiotherapy (85%) and the prognosis is excellent with no patients dying of ML with followup of 2-17 years; while secondary ML 's required chemotherapy, radiotherapy, stem cell transplant, alone or in some combination (81%) and 33% died of ML with a followup 1- 14 years. Overall, ML presenting in the lacrimal gland had the worst prognosis, with more aggressive subtypes (DLBCL, FL and mantle cell lymphoma (MCL) constituting 47% and most cases dying of progressive disease (50%)

**Conclusions** Ocular adnexal lymphomas were predominantly B-cell type with a high overall prevalence of MALT lymphoma. The orbit was the most frequent site of ML in the OA. Primary lymphomas were more common than secondary and were largely MALTL. Radiotherapy alone

was the most frequently used treatment modality for primary disease. DLBCL and FL typically occur in the setting of secondary disease and require a chemotherapy-based approach. ML presenting in the lacrimal gland portended the worst prognosis in our series.

## Oculoplastics- Posters

Saturday 15 June

### Paper #47

Curative excision of large Merkel cell carcinoma and unusual reconstruction of the lower eyelid

Salim Korban, Alice Y. Zhang, Alex Mlynarek, Bryan Arthurs

Purpose Merkel cell carcinoma (MCC) is a rare cutaneous neoplasm of neuroendocrine origin mostly affecting elderly Caucasians and immunocompromised patients. Its biological behavior is locally aggressive and has a high tendency for recurrence and distant metastases. The authors present a case of a large Merkel cell carcinoma of the left cheek with extension into the left lower eyelid that underwent curative surgical excision. Reconstruction of the lower eyelid was achieved at a later date by means of a modified Hughes flap with full-thickness skin graft attached to a free flap taken from the patient's radial forearm.

Study Design Retrospective case report.

Methods A 79-year old Caucasian male presented with a painless exophytic mass on the left cheek, with extension into the left lower eyelid. A diagnosis of MCC was established by biopsy using immunohistochemistry.

Results A head and neck MRI study indicated no intraocular, perineural or bony invasion and no evidence of lymphadenopathy. Within one month after biopsy, the tumor had reached a size of 5.2x4.1x4cm and appeared fungating, ulcerated, solid, white-grey, moderately-defined and was grossly abutting the inner canthus. Wide local excision with frozen section control, complete excision of the left lower eyelid, left parotidectomy and left functional neck dissection were performed. Cheek reconstruction was done using a 10x10cm free flap from the radial forearm. The tumor was invading the left orbicularis muscle, and therefore was staged pT4N0M0. Systemic workup (PET Scan) excluded distant metastases. Adjuvant radiotherapy was administered postoperatively. The patient underwent a secondary reconstruction of the left lower lid using a modified Hughes tarso-conjunctival advancement flap with full thickness skin graft attached to the adjacent cheek/free flap.

Conclusions To the best of our knowledge, we present the largest Merkel cell carcinoma of the face without lymphadenopathy or distant metastases. It is also a unique case of reconstruction with a Hughes flap attached to a free flap taken from the radial forearm that had been used to cover the cheek defect.

## Oculoplastics- Posters

Saturday 15 June

Paper #48

Orbital involvement in the setting of superficial chemical facial burns

Jonathan Hurst, Davin Johnson, Robert Campbell, Stephanie Baxter, Vladimir Kratky

**Purpose** To present a unique case of suspected orbital compartment syndrome in the setting of superficial alkali facial burns without aggressive fluid resuscitation

**Study Design** Case report and review of literature

**Methods** We describe the case of a 13-year old male who sustained alkali burns to the face and ocular surfaces from the explosion of an improvised explosive device. The patient was admitted to pediatric intensive care for mild respiratory distress but was otherwise systemically well and did not receive aggressive fluid resuscitation. He developed markedly elevated intraocular pressure bilaterally and was treated with maximal medical pressure-lowering therapy. Over 12 hours his pressures remained elevated and he developed disc edema, arterial pulsations, clinically tight orbits and complete gaze restriction bilaterally. Urgent canthotomy and cantholysis were performed bilaterally.

**Results** The patient's pressures normalized and gaze restriction resolved. He continues to be treated for ocular scarring and ischemia. His facial soft tissue injuries were deemed to be mostly 1st degree burns with small areas of 2nd degree involvement.

**Conclusions** The patient's elevated intraocular pressure can be explained by several mechanisms. The documented presence of complete gaze restriction and clinical tight orbits suggest an orbital component. Orbital compartment syndrome in the setting of aggressive fluid resuscitation for burns is a documented phenomenon. We believe this is the first reported case of orbital involvement in a burn patient with relatively mild and localized facial burn and without systemic fluid resuscitation.

## Oculoplastics- Posters

Saturday 15 June

Paper #49

Traumatic Complete Evulsion of the Globe and Optic Nerve: An Eye for an Eye?

Jerrod Kent, Yasser Khan

Purpose Evulsion of the globe as a result of trauma is a rare occurrence in the medical literature. Autoenucleation by psychiatric patients is more commonly reported than accidental removal of the eye. Our case reports a traumatic evulsion of the entire globe and optic nerve with sheath with clean, incision-like cuts on the recti muscles and optic nerve.

Study Design Descriptive case report and review of literature.

Methods Case Report.

Results A 68 year old American man was referred from the emergency department with a complete evulsion of the globe and optic nerve. The globe was completely dislocated from the orbit with no tethering structures. The orbit was not fractured and there was no injury to the eyelids. The conjunctiva was completely intact without tissue loss and the blood loss was minimal. The patient had no history of psychiatric disease. The proposed mechanism of injury was a fall from bed onto a floor lamp stand. There was no damage reported of the lamp, nor any broken glass. The patient was visiting Canada from the USA for the first time. Surgical exploration of the orbit showed intact conjunctiva with straight margins, 2 recti muscles were isolated and sutured to an orbital implant. Gross examination of the globe showed the stumps of each of the 4 recti muscles with clean, precise cuts. The optic nerve measured approximately 35 mm in length with sheath intact. The specimen was sent for histological pathology.

Conclusions Previously reported cases of evulsion of the optic nerve describe the eye within the orbit with the extraocular muscles or other tethered soft tissue attached. Previously described mechanisms were from high force or high velocity injuries, such as a MVC, sports injury or assault. There have only been approximately 10 previous cases of full evulsion of the globe. Our case represents a specimen with clean, surgical-like margins and suspicious mechanism. Could this be a case of an eye for an eye?

Oculoplastics- Posters

Saturday 15 June

Paper #50

Metastatic Neuroendocrine Carcinoma to the Orbit.

Sonul Mehta, John Harvey, Dan DeAngelis

Purpose Neuroendocrine tumors include carcinoid tumors and neuroendocrine carcinoma. Orbital metastasis from neuroendocrine carcinoma is a very rare condition. We report the clinical presentation, diagnostic tools, and management strategies used to treat 2 patients that presented with this rare orbital tumor.

Study Design Retrospective chart review

Methods Cases diagnosed with neuroendocrine carcinoma metastasis to the orbit were collected and reviewed.

Results Case 1 describes a 60 year old female who was referred for left lower lid swelling, and found to have left hyperglobus on presentation. Radiologic imaging showed a left inferior orbital mass involving the inferior rectus and inferior oblique. Following surgical debulking, histopathology of the specimen revealed metastatic neuroendocrine carcinoma. Case 2 describes an 84 year old female who presented with diplopia and limited lateral duction of the right eye. Radiologic imaging revealed a right posterior lateral orbital mass. Orbital resection of the tumor revealed a histologic diagnosis consistent with metastatic neuroendocrine carcinoma. Surgical findings, histopathology, and the multidisciplinary management strategies for both patients will be discussed.

Conclusions Early detection and surgical debulking for metastatic neuroendocrine carcinoma to the orbit has palliative benefits. A multidisciplinary management strategy proves beneficial to patients with this rare condition.

## Oculoplastics- Posters

Saturday 15 June

### Paper #51

Association between *Helicobacter pylori* and primary orbital lymphoma.

Evan Kalin-Hajdu, Eric Frost, Annie-Claude Labbé, Simon Couture, Daniel Yu, Angèle Devaux, Jamie Wong, François Codère, Patrick Boulos, Isabelle Hardy

**Purpose** *Helicobacter pylori* (*H. pylori*) is a known cause of gastric carcinomas and can be found in over 90% of gastric mucosa-associated lymphoid tissue (MALT) lymphomas. Despite this reality, to our knowledge, no prospective study has directly assessed the link between *H. pylori* infection and orbital MALT lymphomas. In contrast, the presence of *Chlamydia* infection in orbital MALT lymphoma has been well established, and is known to vary widely with geographic location. The goal of this study was to determine if persistent orbital MALT infection with *H. pylori* or *Chlamydia psittaci* was associated with orbital MALT lymphoma.

**Study Design** This was a prospective, comparative study of 40 consecutive patients with suspected MALT lymphoma or other orbital disease requiring biopsy. All patients were seen between 2009 and November 2012 at the University of Montreal's Maisonneuve-Rosemont Hospital Ophthalmology department.

**Methods** The following were performed: ELISA blood antibody testing for *H. pylori*, polymerase chain reaction (PCR) for *H. pylori* and *C. psittaci* on biopsied orbital lesions, PCR for *H. pylori* and *C. psittaci* on peripheral blood mononuclear cells (PBMCs). Information regarding demographics and previous medical history was also obtained.

**Results** Thirteen patients had confirmed orbital MALT lymphoma, whereas 27 patients had other orbital pathologies ranging from benign reactive lymphoid proliferation to Neurofibroma. Ten patients (25% total, 15% of lymphoma group, 30% of control group) tested positive for serum *H. pylori* antibodies. No patients had positive PCR testing for either *H. pylori* or *C. psittaci* in biopsied orbital lesions or PBMCs.

**Conclusions** Persistent orbital infection with *H. pylori* or *C. psittaci* is not a cause of orbital MALT lymphoma in our patient population. Patients with positive *H. pylori* blood antibodies likely either contracted and eliminated the bacteria in the past or have current asymptomatic gastric *H. pylori* infection.

Pediatrics- Posters

Saturday 15 June

Paper #52

Does 'relaxed muscle' recession of the tight inferior rectus produce satisfactory ocular alignment in thyroid-associated orbitopathy?

Rosemary G. Lambley, Anthony G. Quinn

**Purpose** We report good outcomes in a small series of patients with thyroid-associated orbitopathy (TAO) who had inferior rectus recession using a 'relaxed muscle' technique. The tight muscle is dissected from the globe, then sutured to the sclera where it falls on the globe when the globe is placed in the primary position. Fixed sutures were used. To our knowledge this is the first replication of this technique presented by a surgical team other than the one that initially described it. This technique is useful as the abnormal muscles in TAO make it difficult to predict how big a recession is needed. Conventionally adjustable sutures are used but a large proportion of patients still need more than one operation, and some surgeons believe that adjustable sutures should never be used for inferior rectus because of the high risk of muscle slippage.

**Study Design** Retrospective case series of patients with diplopia due to TAO undergoing inferior rectus (IR) recession by a single surgeon (AGQ) using 'relaxed muscle' positioning.

**Methods** Patients with quiescent TAO undergoing IR recession using the relaxed muscle technique between 2006 and 2010 were identified using the operating room registers and case notes. Details of pre-and postoperative diplopia symptoms, measurements of vertical deviation, stereopsis tests and, where available, Hess charts were retrieved. The main outcome measures were freedom from diplopia and postoperative alignment. Relaxed muscle positioning was done in all cases as follows. After passing a double-armed 6-0 polyglactin (Vicryl) muscle suture parallel to the insertion and dissecting the muscle insertion from the globe, the globe was placed in the primary position and the muscle was allowed to fall on it. The distance from the limbus to the new position of the anterior border of the muscle was measured using a Helveston curved rule. The muscle was sutured to the sclera in this position.

**Results** Four patients were identified, in whom six IR muscles were recessed as described. One IR muscle in the series had been recessed previously. All patients complained of diplopia preoperatively and had elevation defects in the operated eye or eyes due to tight IR. Median follow-up was 7.5 months, range 4.5-14 months. All four patients were free from diplopia at final follow-up. One needed a small spectacle-incorporated prismatic correction to achieve this, which was well-tolerated. Late overcorrection was not apparent. No patient had further

strabismus surgery done or planned during follow-up.

**Conclusions** This small series supports the reproducibility of good clinical outcomes from 'relaxed muscle positioning' in IR recession in quiescent TAO by a second surgical team. Satisfactory outcomes can be achieved in IR recession in TAO using 'relaxed muscle' positioning without postoperative adjustment.

## Pediatrics- Posters

Saturday 15 June

### Paper #53

A clinical comparison of non-cycloplegic and cycloplegic autorefraction using Spot™ (PediaVision LLC, Pompano Beach, FL) to manual cycloplegic retinoscopy in a pediatric population.

Adil Bhatti, Rami Abo-Shasha, Rejean Munger, Michael O'Connor

**Purpose** Cycloplegic manual retinoscopy is the gold standard for determining pediatric refractive error. As an alternative to this labour-intensive technique, there is continued interest in autorefraction, particularly for use in pediatric vision screening programs.

**Study Design** Case series, retrospective chart review.

**Methods** Thirty-three children underwent autorefraction (non-cycloplegic and cycloplegic) and manual cycloplegic refraction by a staff ophthalmologist in the pediatric ophthalmology clinic. Refractive errors were converted to spherical equivalents. Data from the right eye of each subject were used. Statistical measures of performance (sensitivity, specificity, positive and negative predictor values) were then calculated for both non-cycloplegic and cycloplegic autorefraction conditions: myopia ( $< -1D$ ), hyperopia ( $+>2D$ ), cylindrical ( $>1D$ ), and anisometropia ( $>1.5D$  in equivalent sphere), using manual retinoscopy as the gold standard.

**Results** The mean differences between non-cycloplegic autorefraction and cycloplegic retinoscopy, non-cycloplegic autorefraction and cycloplegic autorefraction, and cycloplegic autorefraction and cycloplegic retinoscopy were  $-1.95 \pm 2.38$ ,  $-2.10 \pm 2.50$ , and  $0.06 \pm 2.40$ , respectively. Sensitivity and specificity for non-cycloplegic autorefraction were as follows: myopia (sensitivity 50%, specificity 93.1%), hyperopia (sensitivity 21.4%, specificity 94.7%), cylinder (sensitivity 69.2%, specificity 70%), and anisometropia (sensitivity 27.8%, specificity 93.3%). Cycloplegic autorefraction for myopia revealed sensitivity 66.7% and specificity 100%; for hyperopia, sensitivity 80% and specificity 89.5%; for cylinder, sensitivity 50% and specificity 63.2%; and for anisometropia, sensitivity 85.7% and specificity 86.7%.

**Conclusions** These results suggest that the Spot™ autorefractor is fairly effective at detecting clinically significant refractive errors under cycloplegic conditions. Under non-cycloplegic conditions, induced accommodation may limit the instrument's ability to effectively detect hyperopia and anisometropia in pediatric subjects. This factor should be taken into consideration when using these types of devices for pediatric vision screening.

Pediatrics- Posters

Saturday 15 June

Paper #54

Influence of Target Range on success of strabismus surgery in children.

Paulita Pamela P. Astudillo, Melissa Cotesta, Jennifer Schofield, Derek Stephens, Stephen Kraft, Kamiar Mireskandari

Purpose To determine if achievement of the ideal target range immediately post-operatively predicts long-term success of strabismus surgery.

Study Design Retrospective chart review

Methods The clinical charts of patients under 12 years old who underwent horizontal strabismus surgery were reviewed. The ideal post-operative target range was defined as 0 to 8 PD of esotropia in exotropic patients and within 4 PD of orthotropia in esotropic patients measured within one week after the surgery. The visual acuity, presence of amblyopia, binocularity, type of strabismus, surgical procedure, achievement of the target range and surgical success were documented. Long-term surgical success was defined as a measurement within 10 PD of orthotropia with minimum 6 months follow up.

Results A total of 352 patients were included in the study. The mean follow-up time was 18 months. Patients who were within target range had a higher success rate than those outside target range (75.6% vs 57%  $p = 0.004$ ). Multiple regression analysis revealed that being within target range was the strongest predictor of long term success (OR=2.3 range 1.4-3.7). Other factors that affected success were strabismus type and prematurity. Esotropic patients were more likely to be successful (OR = 1.9 range 1.2-3), and premature patients had a poorer outcome (OR = 0.2 range 0.1-0.8).

Conclusions Achieving the ideal target range within one week after surgery is associated with a high rate of long-term success in horizontal strabismus surgery in children.

Retina- Posters

Saturday 15 June

Paper #55

Evaluating the effect of two different concentrations of brilliant blue G on retinal pigment epithelial cells in presence of metal halide light for chromovitrectomy: comparative assessment of distance and duration of illumination

Keyvan Koushan, Sankarathi Balaiya, Tatiana McLauchlan, Kakarla V. Chalam

**Purpose** To derive safety parameters for use of Brilliant Blue G (BBG) for chromovitrectomy by investigating changes in cellular viability and morphological characteristics of human retinal pigment epithelial cells that were exposed to Brilliant Blue G at different concentrations and exposure times, at simultaneously illuminated using surgical light source.

**Study Design** in vitro prospective controlled study

**Methods** Human retinal pigment epithelial cells (ARPE-19) were exposed to 2 concentrations (0.25 and 0.5 mg/mL) of BBG and illuminated with surgical metal halide light at various time intervals of 1, 5 and 15 minutes. Illumination was performed at various distances based on surgical distance of light illumination. Illumination levels were measured using a light meter and cell viability was assessed using WST-1 assay. Structural changes of a cell after a metal halide illumination such as cell length and cell width were micro-graphed and quantified using MATLAB statistical software.

**Results** At 2 cm distance of illumination, 0.25 mg/ml BBG lowered viability of RPE cells to  $89.6 \pm 4.3\%$ ,  $83.9 \pm 10.9\%$  and  $38.9 \pm 5.1\%$  of controls with 1, 5, and 15 minutes of exposure, respectively. Similarly, 0.5 mg/ml BBG at 2 cm distance of illumination lowered the viability of RPE cells to  $93.7 \pm 2.8\%$ ,  $59.6 \pm 16\%$  and  $34.7 \pm 3.5\%$  of controls with 1, 5, and 15 minutes of exposure, respectively. At 3.5 cm of exposure, cells showed more viability: cells exposed to 0.25 mg/ml BBG showed  $98.85 \pm 3.3\%$ ,  $95.31 \pm 7.12\%$  and  $62.07 \pm 3.0\%$  of viability of control cells after 1, 5, 15 minutes of exposure, respectively. Similarly, cells exposed to 0.5 mg/ml BBG showed  $104.50 \pm 8.96\%$ ,  $89.27 \pm 6.88\%$  and  $63.94 \pm 4.77\%$  of viability of control cells after 1, 5, 15 minutes of exposure, respectively ( $P < 0.01$ ). Morphometric evaluation of RPE cells showed significant morphological changes with both the concentrations of BBG irrespective of their distance of light illumination. In particular, longer exposure times correlated with increased width (swelling) of RPE cells.

**Conclusions** At the close illumination distance of 2 cm, RPE cells exposed to BBG showed decreased viability with both concentrations of BBG regardless of exposure time. The longer illumination distance of 3.5 cm, which is the surgically relevant distance, provided a better safety margin and only caused decreased cell viability after longer exposure times and especially with

higher concentration of BBG. Our results show that BBG can have cytotoxic and morphological side effects on cultured human RPE cells especially when used in higher concentration, longer exposure time, and particularly when used in conjunction with shorter distance of illumination. The distance of illumination, the concentration of BBG and its exposure time should be considered as safety parameters when this dye is used in chromovitrectomy.

Retina- Posters

Saturday 15 June

Paper #57

Spontaneous Closure of Traumatic Macular Holes: A Series of 3 Cases.

Micah Luong, Monique Munro, Micheline C. Deschenes, Feisal Adatia, Geoff Williams, Amin Kherani

**Purpose** To report three cases of traumatic macular hole, and discuss the timeline of when to perform surgery and to what demographics this should apply to.

**Study Design** Observational case series.

**Methods** Three patients with unilateral traumatic macular holes, secondary to blunt trauma, were followed. Clinical records were reviewed. Each patient's fluorescein angiography and optical coherence tomography (OCT) were monitored.

**Results** Spontaneous closure of unilateral macular holes, secondary to blunt trauma, were observed in three healthy young patients. Two males suffered sports-related injuries and a female was in a motor vehicle accident. All patients had no prior history of ocular trauma, surgery or family history of ocular disease. Each patient developed decreased visual acuity following the inciting trauma, with visual acuities ranging from counting fingers to 20/200. In all of the eyes, fundus examination in conjunction with OCT revealed full-thickness macular holes, not complicated by epiretinal membrane formation and posterior vitreous detachment. The macular holes were observed to spontaneously close in one to four weeks in each patient. All three patients experienced an improvement in visual acuity of a minimum of two Snellen lines; one patient improved from 20/200 to 20/50. The resolved macular holes have remained closed, with stable vision, and patients are being followed at yearly examinations.

**Conclusions** Traditional management of closing traumatic macular holes has been vitrectomy +/- peeling with fluid-gas exchange (4). Although several authors reported efficacious results of vitrectomy, spontaneous closure has been documented in many cases (5-7,9-12). The natural history of the spontaneous resolution of traumatic macular holes is uncertain but has been reported predominantly in young, male populations with small perforation size (11). It is important to note that visual prognosis for a spontaneously resolved macular hole is equal to that of surgical intervention (11). These findings merit a period of observation, thus avoiding surgery and potential complications. There is little consensus regarding the precise period for observation. Duration prior to closure varies widely in the literature, with the largest review observing closure in one to sixteen weeks (1,3,5-12). While an observation period in older populations is still debated, based on the spontaneous closure of macular holes witnessed in this series, as well as in the literature, an observation period could be considered, particularly in young populations (1,3,5-12).

Retina- Posters

Saturday 15 June

Paper #58

## TRANSCONJUNCTIVAL SUTURELESS 20-GAUGE VITRECTOMY: OUTCOME AND COMPLICATIONS

Marwan A. Abouammoh, Mohammad A. Abouammoh, Ahmed A. Mousa, Jeffrey Gale

**Purpose** To report the rate of hypotony, potential complications, and the need for sclerotomy suturing in eyes operated on with 20-gauge transconjunctival pars plana vitrectomy.

**Study Design** Retrospective cohort

**Methods** Retrospective chart review of 480 eyes that underwent 20-gauge transconjunctival pars plana vitrectomy was conducted. We assessed the intraocular pressure (IOP) at 1 day and 1 week postoperatively, change in visual acuity, and intra- and postoperative complications with at least 1 year follow-up.

**Results** We reviewed 480 eyes of 480 patients (n=245, 51.1% males) with a mean age of 65.5 years ( $\pm 14.7$  (SD)). Mean intraocular pressure on day 1 was 20.5mmHg ( $\pm 8.9$ ) and on day 7 was 16.8mmHg ( $\pm 8.3$ ). Twelve eyes (2.5%) had hypotony (IOP<7mmHg) on day 1, which normalized in 7 patients on day 7. Mean visual acuity was (0.99 $\pm$ 0.7) (LogMAR $\pm$ SD) preoperatively and (0.67 $\pm$ 0.6) post-operatively (p <0.0001). Mean gas fill was 75% ( $\pm 16.7$ ) on day 1. Air tamponade had a significantly lower fill than both SF6 and C3F8 on day 1 (p<0.0001). Only six cases (1.3%) had complications. Rate of complications was not associated with type of tamponade (p =0.076), or IOP on day 1 (P=0.693). There were no cases of endophthalmitis.

**Conclusions** The 20 gauge transconjunctival sutureless vitrectomy seems safe with a low rate of complications and good final outcome.

Retina- Posters

Saturday 15 June

Paper #59

Could Intravenous Rituximab be used for the Treatment of Cancer-Associated Retinopathy?

Chris Or, David Collins, Andrew Merkur, Yujuan Wang, Chi-Chao Chan, Farzin Forooghian

**Purpose** The clinical management of autoimmune retinopathies remains a challenge mainly due to their rare incidence and absence of standardized treatment protocols. Herein, we present clinical and indirect immunohistochemical findings describing the successful treatment of cancer-associated retinopathy (CAR) with rituximab, a monoclonal antibody against CD20+ B-lymphocytes.

**Study Design** Case report with clinicopathologic correlation.

**Methods** Case report with clinicopathologic correlation.

**Results** A 51-year-old Caucasian female with adrenal adenoma presented with a 1-year history of bilateral visual deterioration. Spectral-domain optical coherence tomography (SD-OCT) showed attenuation of the inner segment/outer segment (IS/OS) junction in both eyes, with some disruption of the external limiting membrane in the right eye. Indirect immunohistochemistry (IHC) using patient sera as the primary antibody showed strong immunoreactivity against normal human retina. Four months after treatment with rituximab, the patient presented with vision improvement in the right eye and vision stabilization in the left. Progressive retinal degeneration as seen on SD-OCT was partially reversed, as demonstrated by partial restoration of the IS/OS junction of the right eye. Indirect IHC after treatment showed decreased anti-retinal immunoreactivity.

**Conclusions** Our case describes the successful treatment of CAR with rituximab. Both clinical and immunohistochemical parameters improved following treatment with rituximab in this case. These findings support the use of rituximab as a treatment for CAR.

Retina- Posters

Saturday 15 June

Paper #60

Neovascular Events In Eyes With Central Retinal Vein Occlusion (CRVO) Undergoing Intravitreal Bevacizumab Or Ranibizumab Therapy

Rayan A. Alshareef, Francis C. DeCroos, David Lally, Mohammed Khuthaila, Allen C. Ho, Carl D. Regillo, Marc J. Sporn

**Purpose** To characterize the onset of and identify factors associated with neovascularization in eyes with CRVO undergoing anti-vascular endothelial growth factor (VEGF) therapy. The onset of neovascular events such as neovascularization of the iris (NVI) or neovascular glaucoma (NVG) in the context of serial anti-VEGF injections has not been well characterized.

**Study Design** Retrospective chart review.

**Methods** Consecutive patients at Wills Eye Institute who underwent intravitreal bevacizumab (IVB) or ranibizumab (IVR) for treatment of CME secondary to CRVO between 2005 and 2011 were retrospectively reviewed. Eyes treated at least twice with IVB or IVR were included. Data collected included age, perfusion status of CRVO, onset of CRVO, best corrected visual acuity (BCVA), and type and onset of neovascular event.

**Results** Twenty eyes of twenty patients were identified. Mean duration of CRVO prior to treatment was 3.2 months (standard deviation or SD = 4.2 months). Mean follow-up was 26.7 months (SD = 14.7 months). At baseline 14 eyes (70%) demonstrated 10 or greater disk diameters of nonperfusion based on fluorescein angiography and were categorized as ischemic. Patients received between 2 and 12 IVB or IVR injections (mean=4.9) prior to any neovascular event. Mean time from first visit to any neovascular event was 13.3 months (SD = 9.0 months). Mean treatment free interval from last IVB or IVR to any neovascular event was 5.3 months (SD = 5.6 months). Neovascularization of the iris or angle was observed in 12 eyes (60%), vitreous hemorrhage was observed in 7 eyes (35%), and neovascularization of the disk was observed in 1 eye (5%). All neovascular events necessitated panretinal photocoagulation and 4 eyes (20%) required glaucoma shunt surgery. Of the 20 eyes, 14 (70 %) presented with vision 20/400 or worse and 15 (75%) demonstrated 20/400 or worse vision after two anti-VEGF injections.

**Conclusions** Neovascular events may occur both in patients undergoing concurrent monthly anti-VEGF therapy as well as patients who have discontinued therapy. These events are delayed compared to the natural history of CRVO related neovascular events.

Retina- Posters

Saturday 15 June

Paper #61

Evaluation of wet Age-Related Macular Degeneration (wAMD) genetic profile interactions with Ranibizumab treatment outcomes: Preliminary Results

Varun Chaudhary, Michael H. Brent, Wai-Ching Lam, Robert Devenyi, Joshua C. Teichman, Michael Mak, Forough Farrokhyar, Ronald Carter

Purpose Ranibizumab injections are the standard of care for wet Age Related Macular Degeneration, but variable outcomes in different patients are poorly understood. This prospective pharmacogenetic study evaluates the ability of genetic testing to predict which patients will experience moderate vision gain with Ranibizumab treatment and those who will not.

Study Design Double-blinded prospective cohort study.

Methods A total of 40 eyes were evaluated from both investigator sites of  $\geq$  age 50 years of age with active subfoveal CNV secondary to AMD. Cheek swab DNA was analyzed by the Macula Risk test<sup>®</sup> and the assay results were sorted into one of 3 levels of risk - reduced risk, average risk, and moderate to increased risk categories - adjusted for genetic polymorphisms, age, blood pressure, and smoking history. Best-corrected visual acuity (BCVA) using electronic ETDRS charts, intraocular pressure and Central Macular Thickness (CMT) using OCT was measured for the study eye each month for six months after baseline visit.

Results The mean age of the study population was 79.3 years of age, most being Caucasian (95%). After 6-month follow-up, patients with reduced risk (n=9) demonstrated a mean increase of 11.33 ETDRS letters and the mean CMT reduction of 68.34  $\mu$ m. Patients with average risk (n=11) demonstrated the mean greatest increase of 12.04 ETDRS letters and mean CMT reduction of 63.47  $\mu$ m. Patients with moderately to highly increased risk (n=20) demonstrated a mean increase of 11.05 ETDRS letters and mean CMT reduction of 46.41  $\mu$ m. Examining the CFH gene in particular, patients with the reduced risk haplotype gained 17.57 ETDRS letters while those with the increased risk haplotype and greatly increased risk haplotype gained 9.24 and 10.27 ETDRS letters respectively.

Conclusions After a six-month follow up, the difference in ETDRS letter gain was not statistically significant between the three risk groups. However, groups with increased risk had lower reductions in CMT and groups with reduced risk had the greatest reduction in CMT. There was also a trend for more significant visual acuity improvement in patients with the reduced risk haplotype of the CFH gene versus patients with the increased risk haplotypes.

## Retina- Posters

Saturday 15 June

### Paper #62

Relationship of age and drusen load with inflammatory cytokines in vitreous of the postmortem human eye.

Jay Ching-Chieh Wang, Sijia Cao, Aikun Wang, Jing Cui, Joanne Matsubara

**Purpose** Recent studies provide evidence that chronic, local inflammation plays an important role in the pathogenesis of age-related macular degeneration (AMD). While aging, complement factor H (CFH) Y402H and drusen load increase the risk of AMD, their relationship to the local inflammatory processes in the eye requires further investigation. In this study, we examined the expression of inflammatory cytokines and growth factors in the vitreous of post-mortem donor eyes graded for drusen load, and categorized by age and single nucleotide polymorphisms for the CFH (Y402H) at risk variant (T>C).

**Study Design** Experimental laboratory study.

**Methods** Sixteen pairs of post-mortem human donor eyes, were obtained from the BC Eye Bank with ethics approval and informed consent of the donor or donor family in accordance with the principles outlined in the Declaration of Helsinki. The average time from death to tissue processing was 15.14 hr (SD=4.7 hr). The left eyes were dissected circumferentially at the pars plana, and the vitreous and retinal tissues were collected. The right eye was embedded in paraffin for drusen load analyses and future immunohistochemistry. The vitreous samples were analyzed for cytokines and growth factors using a multiplex suspension array (Bioplex™). The retinal tissues were used to genotype for CFH Y402H polymorphism. Data were analyzed for fold changes (FC) by Student's t test, with  $p < 0.05$  being significant. The comparisons made were between CFH genotypes, age groups, and drusen load.

Among the 16 eyes:

1. Percentage of eyes with CC, CT and TT genotype were 4, 10 and 2, respectively;
2. Six eyes were  $\leq 55$  year-old (younger group), while 4 were  $\geq 70$  year-old (older group);
3. Six eyes had drusen, while 10 did not.

**Results** Based on drusen status, IL-13 showed a FC of 2.6 in eyes with drusen compared to eyes without drusen, while VEGF, IL-6, and IL-10 showed marginally significant FC of 3.6, 3.0 and 2.0, respectively ( $p < 0.15$ ). This result was independent of chronologic age.

Based on age, IP-10, MCP-1 and IL-8 showed FCs of 3.7, 3.1, and 3.1, respectively, between the older ( $\geq 70$ ) and younger ( $\leq 55$ ) groups.

Comparison was also made based on CFH Y402H genotypes, taking into account the small TT group. Briefly, IL-18 showed a FCs of 3.29 between the CC VS TT groups, and the result was

independent of chronologic age.

**Conclusions** In this study, we found that aging eyes and eyes with drusen are associated with elevated inflammatory cytokines. Though CFH Y402H CC group showed elevated IL-18, this relationship needs further study due to the small sample size.

Retina- Posters

Saturday 15 June

Paper #63

A case of choroidal osteoma treated with photodynamic therapy and intravitreal bevacizumab

Irfan N. Kherani, Karim Hammamji, Micheline C. Deschenes, Amin Kherani

**Purpose** Choroidal osteomas are a benign intra-ocular ossification found in otherwise healthy eyes. Around 41% of cases will exhibit tumor growth, which can severely affect vision depending on the location of the lesion. Here, we present a case of a juxtafoveal choroidal osteoma treated with photodynamic therapy (PDT) and intravitreal bevacizumab.

**Study Design** Case review.

**Methods** The patient's chart was reviewed noting demographics, history, examination, investigations, management and outcomes.

**Results** We present a case of an asymptomatic 14-year old boy with a choroidal osteoma in the left eye. Examination revealed a visual acuity of 20/20 OU and a juxtafoveal 3x3 mm excavated choroidal osteoma OS with documented growth. After careful review of the optical coherence tomography (OCT), IVFA and B-scan ultrasonography, treatment was offered given the imminent threat to the patient's central vision. Based on a previous case report highlighting the successful regression of a choroidal osteoma following PDT, we treated with half-fluence PDT directly on the lesion. The patient presented 3-weeks post-PDT with decreased vision (20/30) and metamorphopsia. OCT and IVFA findings revealed a choroidal neovascular membrane (CNVM) within the tumour complex. The patient subsequently received two intravitreal bevacizumab injections a month apart which successfully led to a regression of the CNVM. While his visual acuity did return to 20/20 OS, mild metamorphopsia still persisted.

**Conclusions** This case highlights the novel attempted use of photodynamic therapy to treat choroidal osteomas, but cautions on the possible complications of such treatment in juxtafoveal lesions (limited tumor regression and secondary CNVM). It also underlines the effectiveness of intravitreal bevacizumab in the treatment of CNVMs associated with choroidal osteomas.

Retina- Posters

Saturday 15 June

Paper #64

Long term data challenges the safety and efficacy of radial optic neurotomy in patients with optic nerve drusen

Tony Lin, Ian McIlraith, David Nicolle, Tom Sheidow

**Purpose** Radial optic neurotomy (RON) is a surgical treatment originally described for central retinal vein occlusion (CRVO). Surgical treatment with RON was thought to relieve high pressure on the central retinal artery, central retinal vein, and optic nerve fibers by dissecting the scleral ring. Optic disc drusen can cause compression of the neurovascular bundle within the optic nerve. There is no treatment available for optic disc drusen except case reports and case series proposing the use of RON. Previous reports on the short term outcome of RON in optic disc drusen demonstrated efficacy and safety. This case series presents six year outcomes of three patients that challenges the efficacy and safety of RON in patients with optic disc drusen.

**Study Design** Case series

**Methods** Radial optic neurotomy was performed on one of two eyes in three patients with bilateral optic disc drusen with progressive visual field defect. The eye with the worse visual field defect was selected for the operation. Par plana vitrectomy was performed followed by RON. RON was performed using a microvitrectomy blade was used to make an incision into the scleral ring, cribriform plate, and adjacent sclera of the optic disc. Disease progression was monitored in both eyes with ETDRS visual acuity, Humphrey visual field 30-2, and optical coherence tomography.

**Results** Surgery was performed without complications in all three patients. At six years, none of the three patients had improvements in their visual acuity or visual field when compared to baseline. Two of three patients developed visually significant cataract in the treated eye requiring cataract surgery and the third patient developed an epiretinal membrane. Of the three patients, one developed a temporal visual field defect associated with the radial optic neurotomy incision.

**Conclusions** This case series shows six year follow up data that challenges previously reported efficacy and safety of RON in patients with bilateral optic disc drusen. Our study did not show an improvement in visual acuity or visual field in the treated eye. This surgical treatment led to decrease in visual acuity in two of three patients and loss of visual field in one of three patients.

Uveitis- Poster

Saturday 15 June

Paper #65

Dexamethasone intravitreal implant (Ozurdex) in the treatment of sympathetic ophthalmia

Lisa Lagrou, Karim Hammamji, Olga Zouzina, Michael Fielden, Geoff Williams, Amin Kherani

Purpose To present the pathology and management of a case of sympathetic ophthalmia.

Study Design Interventional case report.

Methods This case report describes a 60 year old male, who previously underwent multiple vitreo-retinal and glaucoma procedures in his left eye. He subsequently presented with decreased vision in his right eye (20/200) from a severe panuveitis. Histopathologic findings of the enucleated left eye confirmed the diagnosis of sympathetic ophthalmia. Despite systemic immunosuppression with high dose prednisone, methotrexate, intravenous cyclophosphamide, infliximab and local subtenon kenalog injections, the sympathetic ophthalmia remained chronic and recurrent. A dexamethasone intravitreal implant 0.7mg (Ozurdex, Allergan, Inc., Irvine, CA) was injected.

Results Despite aggressive recalcitrant inflammation, this treatment was successful in providing improved control of the local inflammation secondary to sympathetic ophthalmia. The visual acuity improved to 20/30 allowing for reduction in the systemic immunomodulatory therapies. However, repeat dexamethasone intravitreal implant 0.7mg (Ozurdex, Allergan, Inc., Irvine, CA) was required in 4 months to maintain stability.

Conclusions A dexamethasone intravitreal implant 0.7mg (Ozurdex, Allergan, Inc., Irvine, CA) can be a successful local steroid modality used in the treatment of sympathetic ophthalmia.

Uveitis- Poster

Saturday 15 June

Paper #66

Cases of ocular syphilis from 2000-2009: the experience of 2 Montreal university hospitals

Kinda Najem, Laurence Jaworski, Annie-Claude Labbé, Claude Fortin, Eric Fortin, Marie-Lyne Bélair, Marie-Josée Aubin

**Purpose** In the past ten years, an important increase in cases of syphilis has been observed in Quebec and in Canada. Cases of ocular syphilis have accordingly increased as well. The purpose of our study is to review ocular syphilis cases diagnosed and treated between 2000 and 2009 at Maisonneuve-Rosemont Hospital and Notre-Dame Hospital, in Montreal, and to describe the demographics, different clinical presentations of the disease, proportion of co-infection with HIV, treatment and its outcome in those patients.

**Study Design** Retrospective and descriptive study

**Methods** Medical records of patients who had positive treponemic serologic testing and who visited the ophthalmology department at Maisonneuve-Rosemont Hospital and Notre-Dame Hospital for ocular manifestations related to syphilis between the years 2000 to 2009 were reviewed. Several data were compiled and included: patient demographics; clinical presentation and examination, including best-corrected visual acuity (BCVA); syphilis history in the past; laboratory work-up including syphilis serology and cerebrospinal fluid analysis; HIV status; ophthalmology diagnosis; medical and surgical treatment; subsequent syphilis serology and final BCVA.

**Results** In total, 91 patients were included in the study. 80% of the patients were males and 20% females. In particular, males between 51 and 60 years old were affected more frequently with an incidence of 26.4%. The second age group with the highest incidence was the one with patients between 41 and 50 years old (16.5%). Around 30% of the patients were males who have sex with males (MSM). Snellen BCVA was converted to logMar notation. A mean of 0.42 (BCVA around 20/50) before treatment was found and a mean of 0.34 (BCVA around 20/40) after treatment was reported. The most common ophthalmologic diagnoses found in those patients were all types of uveitis (anterior being the most frequent one with an incidence of 30.8%). Neurosyphilis was written in several charts, indicating that eye involvement was related directly to that diagnosis. Co-infection with HIV was found in 34.1 % of patients. Lumbar puncture was done in 55% of patients and VDRL serology was positive in 11% of patients. The mainstay of treatment was intravenous penicillin in 74.7% of the patients. In about 85% of patients treated, no history of reinfection was noted.

**Conclusions** Syphilis is known as the great masquerader with a diversified presentation and has

seen a significant increase in the past ten years. In this context, it is primordial to keep this diagnosis in mind, especially since the treatment is readily available and has an excellent outcome.

Uveitis- Poster

Saturday 15 June

Paper #67

## BIOENGINEERING A NOVEL DRUG DELIVERY SYSTEM FOR HUMAN EYE DISEASE

Rahul Sharma, Bo Li, Gordon Laurie, Jin Zhang, Cindy M. Hutnik

**Purpose** Dry eye is the most common eye disease, affecting up to 10% of the general population and 50% of those over 50 years old (Chia et al, '03). Dry eye most often results discomfort to the eye, but may also cause permanent visual compromise (Gayton, '09). Most commonly, dry eye is treated using artificial tear replacements of various chemical compositions (Gayton, '09). No single formulation has emerged as a satisfactory standard of care (Novack, '02). A therapy that would permit effective administration of key bioactive components from natural human tears would be a breakthrough in the treatment of this ubiquitous condition. Lacritin is a promising bioactive molecule given its importance in the healthy tear system (Sanghi et al, '01; Wang et al, '06; Ma et al, '06). It is known that lacritin autostimulates 'basal tearing', which is deficient in most dry eye patients (Sanghi et al, '01) and generally promotes the health of the ocular surface. Development of a contact lens drug delivery system incorporating lacritin into nanoparticle (NP) technology may address several of the short-comings of current treatments.

**Study Design** We hypothesize that mesoporous silica nanoparticle (MSN) technology can be used to provide a controlled release of lacritin. As such, the aim of this experiment is to incorporate recombinant lacritin into MSNs and characterize the protein release from this system.

**Methods** Silica NPs were prepared using cetyltrimonium bromide (CTAB), tetraethyl orthosilicate (TEOS) and 3-(tridroxysiyl) propyl methylphosphate (TPMPH). Recombinant lacritin was labeled with DyLight 488 dye using a commercial kit. To encapsulate lacritin in NPs, labeled lacritin was freeze-dried with the produced NPs. Protein release was assessed using a Spectramax M5 Fluorescent Imager, measured in relative fluorescence units (RFU) and compared to negative and positive controls.

**Results** Recombinant lacritin incorporated within mesoporous silica nanoparticles showed strong release immediately after initiation of lacritin release and protein level peaked within 2 hr, as measured in relative fluorescence units. The rate of protein release decreased consistently following initiation of release eventually reaching a plateau at 24 hr.

**Conclusions** Our results show that MSNs produced using our methodology can effectively encapsulate recombinant lacritin and release the protein in a controlled manner. Our results also suggest a maximal protein release rate immediately following initiation of lacritin release. While these conclusions are encouraging, there are opportunities for improvement in this study that will

be addressed moving forward. Long-term goals of this work will include incorporating lacritin-loaded NPs into polyhydroxyethylmethacrylate (pHEMA) contact lens material and assessing the efficacy of these lenses *in vitro* and *in vivo*.

Uveitis- Poster

Saturday 15 June

Paper #68

Comparison of IOP and postoperative complications in patients undergoing tube shunt or trabeculectomy surgery for uveitis-related intraocular pressure elevation.

Umair Iqbal, Manpartap Bal, Ralf R. Buhrmann, Chloe Gottlieb

**Purpose** To compare rates of successful IOP reduction and complications in patients with uveitis-related intraocular pressure elevation undergoing tube shunt or trabeculectomy surgery.

**Study Design** Retrospective chart review.

**Methods** Patients were identified by an electronic search of one surgeon's billing records for glaucoma surgical procedure codes. Inclusion criteria were: trabeculectomy or tube shunt surgery with diagnosis of uveitic glaucoma or elevated intraocular pressure associated with uveitis. A chart review was conducted and data tabulated for age, surgery type, complications and IOP at 6 months and 1 year. Eyes lost to follow-up were excluded from the analysis.

**Results** Data were collected from 28 eyes of 26 patients of whom 14 were male (53.8%) and 12 (46.2%) were female. The mean age at the time of surgery was  $53.5 \pm 16.5$  years (range 23-89 years). Most eyes underwent trabeculectomy surgery with MMC (23 eyes, 82.1%) while an aqueous tube shunt was implanted in 5 eyes (17.9%). Four eyes (80%) had Baerveldt valve implanted and 1 (20%) had Ahmed valve implantation. Data was collected at 6 months and 1 year. At 6 months, 21 eyes (91.3%) in the trabeculectomy group met the success criteria of IOP  $\leq 21$ mmHg while 4 eyes (80%) met the success criteria in tube shunt group. By 1 year, 5 eyes (2 trabeculectomies and 3 tubes) were lost to follow-up and tube shunt failed in 1 eye which required a second operation. Therefore, 19 eyes (90.5%; 21 eyes) in trabeculectomy group met the success criteria of IOP  $\leq 21$ mmHg while 1 eye (50%, 2 eyes) in tube shunt group met the success criteria. Moreover, within the trabeculectomy group, 9 eyes (39.1%; 23 eyes) at 6 months required one or multiple post-op needling procedures to control IOP and by 1 year no additional needling was required in the remaining 21 eyes. Bleb leaks occurred in 4 eyes (17.4%, 23 eyes) at 6 months.

**Conclusions** In the patients studied, trabeculectomy with MMC was the most common type of surgical treatment. By the end of 6 months, 91.3% eyes met success criteria in trabeculectomy group compared to 80% eyes in tube group. These numbers decreased to 90.5% and 50% respectively by 1 year. Complications also occurred after trabeculectomy which required needling or leak repairs to control IOP. No such complications threatening IOP control occurred in the tube shunt group.

## Vision Rehabilitation- Posters

Saturday 15 June

Paper #69

Care burden and depression in the caregivers of visually impaired patients in Ontario

Zainab Khan, Puneet Braich, Jaspreet S. Rayat, Lin Xing, Munir Iqbal, Karim Mohamed, Karim Rahim, David Almeida

**Purpose** Care burden is an independent risk factor for mortality among elderly spousal caregivers and many caregivers experience depression during the caregiving period. Recently it has been shown that the incidence of caregiver burden and depression is high for blind patients in India; however, no studies on a Canadian population have examined this relationship. This study describes the degree of burden and the prevalence of depression among individuals caring for visually impaired patients in Ontario.

**Study Design** Clinic-based, cross-sectional, prospective survey/questionnaire of caregivers of patients with visual impairment.

**Methods** We included caregivers of patients from a single tertiary-care centre (Kingston, Ontario, Canada). Caregivers provided care to a close family relative whose sole impairment was visual. Main outcome measures included the Burden Index of Caregivers (BIC) to measure care burden and the Centre for Epidemiologic Studies Depression (CES-D) scale to determine depression. Caregivers completed the Short-form 12 (SF-12) Health Survey to measure overall health from the caregiver point of view.

**Results** We included 236 caregivers of 236 patients with visual impairment. Patients were sorted by vision in the better eye into two groups for comparison: visual acuity better than 6/60 (n=160) and legally blind (visual acuity 6/60 or worse, n=76). Caregivers of legally blind patients experience higher overall burden (p=0.0059) and were more likely to identify that they could not freely leave the home because of caregiving (p<0.0001), did not have enough time for personal care because of caregiving (p=0.0008), and found existential difficulties with providing care (p=0.008). Significant correlations exist between the caregiver SF-12 physical component summary (PCS) with overall burden (p=0.009) and the mental component summary (MCS) with patient visual acuity (p=0.025). Regression analysis identified the inability to leave the home because of caregiving (time domain) predicted by hours required for close supervision, hours spent caring per day, and the SF-12 MCS (p<0.0001). A trend was seen in prevalence of caregiver depression which increased from 3.8% in the visual acuity better than 6/60 group to 9.7% in the legally blind group (p=0.1145).

**Conclusions** In Ontario, caregivers of patients with severe visual impairment experience significant burden. Patient vision loss is reflected in lower caregiver SF-12 PCS & MCS scores indicating a negative effect on caregiver physical and mental health. Additionally, a trend exists

revealing an increased prevalence of depression in caregivers of patients with visual acuity 6/60 or worse. Given the ramifications of caregiver burden and depression, primary care physicians, vision health specialists and eye health organizations should be aware of this relationship to identify optimal opportunities for intervention.

## Vision Rehabilitation- Posters

Saturday 15 June

Paper #70

Educational and vision-assistive smartphone Apps for patients: a quantitative evaluation

Stephanie Kletke, Sourabh Arora, Feisal Adatia

**Purpose** To identify and quantitatively evaluate high quality patient educational and vision assistive Apps.

**Study Design** Systematic search, validated quantitative evaluation

**Methods** Webstores of major smartphone platforms, including iPhone (App Store) and Android (Market) were searched to identify vision assistive and educational Apps targeting patients. Quantitative evaluation was performed using the Quality Component Scoring system (QCS), which assessed for: ownership, purpose, authorship, author qualification, attribution, interactivity, and currency, with a maximum possible score of 13. For vision assistive Apps, usability parameter assessment included: interface design, ease of use/user feedback, navigation, terminology, and low vision accessibility, yielding a maximum possible score of 10. The validated Technical Component Score System (TCS) was used for educational Apps only, and tested for: disease definition, causes, epidemiology, risk factors, diagnosis, classification, treatment, and prognosis, with a maximum possible score of 16. Average user ratings, App cost, and links to other resources were also considered. T-test, ANOVA, Spearman's bivariate analyses were used to compare scores based on purpose/learning method, educational versus assistive, cost of App, and user ratings.

**Results** Thirty-four (23 vision assistive, 11 educational) smartphone Apps were included for analysis. Amongst all Apps' QCS, the mean attribution score (indicating use of references) was the lowest ( $0.15 \pm 0.4$ ), while the purpose score (indicating statement of App purpose) was the highest ( $1.7 \pm 0.5$ ,  $p < 0.001$ ). For assistive Apps, the mean usability total was  $6.4 \pm 1.7$ , and the combined QCS and usability total was  $17.6 \pm 2.9$  (maximum possible score = 23). Patient-appropriate terminology scored the highest (2.0) and low-vision accessibility scored the lowest ( $0.78 \pm 0.52$ ,  $p < 0.001$ ). Number of ratings for an App was significantly correlated with its usability score (Spearman's  $\rho = 0.513$ ,  $p = 0.012$ ) and combined total score (Spearman's  $\rho = 0.422$ ,  $p = 0.045$ ). Amongst educational Apps, the mean TCS total was  $8.1 \pm 5.3$  and the combined QCS and TCS total was  $18.6 \pm 7.4$  (maximum possible score = 29). The most common learning method was text-based (82%) while the remainder were video/audio-based (18.2%). The TCS scores were significantly higher for text-based Apps ( $9.3 \pm 5.1$ ) compared to video/audio-based ( $2.5 \pm 0.7$ ,  $p = 0.004$ ).

**Conclusions** This study has provided a list of patient educational and vision assistive Apps,

ranked by order of quality and categorized by their purpose/learning method. This will allow patients to access Apps most suited to their needs, and physicians to make recommendations. The quality of current and future Apps can be enhanced through consideration of the QCS, TCS, and App usability parameters.

Pathology- Posters

Saturday 15 June

Paper #74

An orbital tumour introduces a diagnostic twist in a case of metastatic prostate carcinoma.

Edward B. Moss, James Farmer, Vladimir Kratky

**Purpose** To review an unusual case of orbital tumour that presented to our oculoplastics service.

**Study Design** Retrospective case report.

**Methods** Chart review of an individual case with review of the literature.

**Results** A patient with metastatic prostate carcinoma was referred to oculoplastics with an orbital lesion not responding to androgen deprivation therapy. There was disagreement between the referring specialties, Urology and Radiation Oncology, regarding the necessity of tissue diagnosis. Following the oncologist's advice, a biopsy was obtained, and a second malignancy was diagnosed: orbital follicular lymphoma.

**Conclusions** This unusual case of a patient with two concurrent neoplastic processes illustrates several useful learning points for care of a patient with metastatic disease. The development of a particular lesion that was atypical in its response to therapy and its location was a reasonable prompt for additional diagnostic work-up. Such a patient likely benefits from the identification of a second, treatable disease process.

## Cornea- Refractive Surgery Symposium

Saturday 15 June

Paper #71

Small aperture corneal inlay for the treatment of presbyopia with and without refractive error

Jeffery Machat

**Purpose** To evaluate the efficacy of implantation of a small aperture corneal inlay in combination with LASIK or in a lamellar pocket for the treatment presbyopia with and without refractive error.

**Study Design** Retrospective analysis of global registry data for presbyopic patients treated with a small aperture corneal inlay.

**Methods** The KAMRA inlay (AcuFocus, Irvine, CA) is a 3.8 mm diameter, 5-micron thick, opaque annulus with a 1.6 mm central aperture. The inlay is inserted into the cornea under a femtosecond laser-created, 200-micron flap or lamellar pocket in the non-dominant eye. Ametropic patients underwent concurrent LASIK procedure. Visual acuity results for all groups at 12 months were analyzed from a global data registry.

**Results** A total of 3,896 ametropic patients, 245 emmetropic, and 912 post-LASIK patients were treated. Across the three patient groups near visual acuity improved from J9-J10 to J1-J2 between pre-op and 12 months post-op. Mean achieved uncorrected distance visual acuity for each group at 12 months was 20/20. Updated results will be presented.

**Conclusions** Implantation of a small aperture inlay for the treatment of presbyopia with and without a combined LASIK procedure improved near visual acuity while maintaining good distance visual acuity in this large series of patients.

## Cataract Surgery

Saturday 15 June

### Paper #72

The role of patient choice in influencing wait times for cataract surgery six years after the wait times initiative

Victoria Leung, Jackie Vanek, Rosa Braga-Mele, Donna Punch, Yaping Jin

**Purpose** To assess the role of patient choice in influencing wait times for cataract surgery.

**Study Design** This was a cross-sectional study designed to examine patient factors that contribute to wait time management at the Kensington Eye Institute (KEI) - the largest cataract facility in Ontario.

**Methods** Patients attending KEI for cataract surgery were invited to complete a standardized questionnaire in 2010-2011. The questionnaire asked about patient experience, involvement in determining wait time, satisfaction, and socio-demographics. Differences in median wait times were statistically tested with the Wilcoxon test. Factors associated with declining the first available surgery date were analyzed with prevalence ratios (PR) and 95% confidence intervals (CI), as derived from log-Poisson regression analysis.

**Results** The analysis included 496 participants aged 40 years or older. The mean age was 70 years. Females and first eye surgeries each constituted 60% of participants. Overall, 90% of patients underwent surgery within 21 weeks. The median wait time was 8 weeks (ranging from 1 to 260 weeks). In 16% of patients, the wait time was greater than the pan-Canadian benchmark of 16 weeks. About 17% of patients deemed their wait time unacceptable. Over one-fifth (21%) of patients did not accept the first available surgery date. Major reasons included planned travel or holidays (35%), family responsibilities (14%), or an earlier date became available (13%). Excluding those with "an earlier date became available" (n=13) and "cancellation by surgeon" (n=3), the proportion of patients that declined the first available date fell to 18%. Individuals with a university or college education (PR 1.6, 95% CI 1.0-2.5) and those with English as a first language (PR 1.4, 95% CI 0.9-2.3) were more likely to decline. Of those who did not accept the first available date, 84% (70/83) had their surgery postponed by 2 weeks or more. The median wait time amongst those who declined (8.5 weeks) was significantly longer than those who accepted (6 weeks, p=0.02).

**Conclusions** One in five patients did not accept the first available date for cataract surgery in 2010-2011 at KEI. Wait times were significantly shorter among patients who accepted the first available date compared to those who did not. Patient choice seems to influence wait times for cataract surgery. This may be an important consideration for decision makers when setting wait time benchmarks for cataract surgery.

## Cataract Surgery

Saturday 15 June

### Paper #73

Examining the relationship between clinical efficiency versus education in the departments of general internal medicine and ophthalmology

Laura Quigley, Victoria Leung, Wai-Ching Lam, Shaun Singer, Rodrigo Cavalcanti, Alison Loat, Brian Hodges

**Purpose** To investigate healthcare personnel's experiences in managing the dual responsibilities of achieving clinical efficiency and meeting medical residents' educational needs in order to formulate optimization strategies for both domains. This study focused on General Internal Medicine (GIM) and Ophthalmology. In Ontario, upstream Emergency Department wait time strategies have significantly affected GIM practices; In Ophthalmology, cataract surgery has been particularly influenced by the establishment of Kensington Eye Institute, an independent health facility that specializes in ambulatory cataract surgery.

**Study Design** Purposive qualitative interview study.

**Methods** An interview series was conducted with key stakeholders (residents, medical and allied health staff, clinical and educational administrators) in General Internal Medicine (GIM) at the Toronto Western Hospital (TWH), as well as in Ophthalmology at TWH and the Kensington Eye Institute (KEI) in Toronto, Canada. Purposive sampling was used to identify key informants. Semi structured interviews were conducted. NVivo 10, developed by QSR International, was used to manage and code the qualitative data. Following a team meeting with the research group to review the open coding structure, an axial coding structure was developed and the data assembled.

**Results** Fifteen GIM and 10 Ophthalmology stakeholders were interviewed. Main themes were consistent across GIM and Ophthalmology. Overarching themes included: efficiency is a major focus at the institutions where residents work and learn; clinical efficiency and educational opportunity are inversely related; however, key informants believed an optimal balance can be achieved. Major factors that offset the balance in favour of efficiency included: university goals being subsumed by clinical demands of the organization; misaligned expectations between residents and staff; ambiguous accountability; and intangible or lack of incentives for teaching. Furthermore, early learners and surgical learners seemed to be most negatively influenced by the emphasis on clinical efficiency.

**Conclusions** Key stakeholders in both General Internal Medicine and Ophthalmology revealed that their healthcare institutions currently emphasize efficiency, and this may have a negative impact on educational opportunity. In the current context, improvements may be achieved by: introducing greater university presence in operations planning at healthcare institutions; reiterating to all healthcare providers the dual responsibility of residents to provide service and

learn; creating educational metrics as a way of ensuring accountability to resident teaching; and fostering greater recognition of healthcare providers who teach. Without a doubt, efficiency is a main determinant of high quality care; however, in order to maintain sustainable high quality care, there may exist a growing need for efforts aimed at rebalancing the focus between efficiency and educational opportunity.

## Cataract Surgery

Saturday 15 June

Paper #74

Cataract surgery and patient comprehension: assessing physician pre-operative communication

Jaspreet S. Rayat, Chris Hanson, Ian MacDonald

**Purpose** Cataract surgery is the most common surgery in North America. The patient profile tends to be varied and can pose communication barriers when attaining consent. What do patients understand about cataracts and the surgical procedure? What do patients remember and understand in regards to the risks and benefits of surgery? Are patients content with their understanding? Are there ways to improve physician-patient communication? This study assesses patients' information retention and recall under stressful circumstances.

**Study Design** Mixed methods prospective study.

**Methods** We conducted the study at the Royal Alexandra Hospital in Edmonton, Alberta, Canada. Patients received questionnaires pre- and post-operatively. Six consenting surgeons allowed their patients to be surveyed. There were 55 patients given a pre-operative questionnaire between March 1-15, 2012 and 27 patients given a post-operative questionnaire between March 16-30, 2012. All questionnaires were returned in sealed envelopes.

**Results** There was no significant difference between the pre-operative and post-operative groups based on age, gender, language, and ethnicity. Overall, the majority of patients had a basic understanding of cataracts, cataract surgery, and the associated risks. 92.68% of patients felt they understood what cataracts were, 85.37% felt they had understanding of cataract surgery, and 87.80% felt they understood the risks of surgery. Some surgeons were better than others in obtaining good patient comprehension for post-operative risks. There was a significant difference in patient recall between the following risks discussed by the surgeon: retinal detachment, glaucoma, need for glasses, bleeding, infection, inflammation, decreased vision and double vision. Of these, further analysis showed the "need for glasses" risk was statistically significant ( $p < 0.05$ ) compared to the rest and thus the best retained by the patients.

**Conclusions** Cataract surgery explanations at our site can be months prior to pre-operative consent obtained on the day of surgery. This project looked at both information provided to patients, as well as their retention over the operative course from start to finish. While the majority of patients felt they understood these explanations, there remained 10-20% of patients who did not feel adequately informed to make their consent or fully understand the general steps involved in the surgery. Some surgeons were better at explaining the surgery and risks so that patients had better recall. Exploring and improving our communication to ensure all patients are properly informed is important as we move into an age of patient-based medicine.

Cataract Surgery

Saturday 15 June

Paper #75

Can we improve patient safety using LEAN design principles in the OR?

Hamza Khan

**Purpose** Evaluation and reporting of safety improvements following implementation of a LEAN-inspired design changes in the OR. We evaluated before and after making changes such as streamlined CPS instrument trays and handling, CHECKLIST for surgical safety

**Study Design** Prospective evaluation of parameters such as TASS, intra-operative lint and operative never events. Using the LEAN "5 S" principles to sort, simplify, standardize, sweep and sustain the ophthalmology OR

**Methods** QI review of critical events and near misses were reported in a standardized format. These included episodes of TASS, endophthalmitis, "never events" (wrong patient, wrong eye or wrong IOL). Presence of intra-operative lint in the eye was also noted. Several design and process changes were made during the study followup of 24 months. Quarterly outcomes were reviewed and reported to the operative team for feedback. This information guided further changes in process flow.

**Results** In each quarter there was a reduction in operative lint noted from 11% to 0.5% of cases studied. Never events occurred rarely and one was seen in the pre-and post intervention phase. The final 2 quarters had no such event. Efficiency improvements were also noted during this time with a total reduction of hospital stay for ambulatory cataract surgery. A total reduction of 40 minutes was achieved with final mean transit time of 65 min (38% reduction).

**Conclusions** LEAN design principles can be successfully employed in the ophthalmology OR to improve patient safety. Patient length of stay was concurrently reduced, which resulted in lower anxiety and need for intervention.

## Cornea-Keratoplasty Techniques

Saturday 15 June

Paper #76

Demographics of corneal transplantation in Canada in 2012

Angela Qiao Zhang, Darya Rubenstein, Aryeh Price, Elie Côté, Max Levitt, Linda Sharpen, Allan R. Slomovic

**Purpose** The objectives of this study were to determine demographics of Canadian corneal transplant surgeons (CTSs), donor tissue availability and waitlist length for each province, need for Eye Banks to provide precut tissue, status of ocular stem cell transplant and limiting factors for the number of corneal transplants performed in Canada.

**Study Design** A survey of all Canadian CTSs was conducted between June and August 2012, with a concurrent assessment of eye bank data in Canada.

**Methods** An anonymous and voluntary survey was sent out to all Canadian CTSs electronically and faxed when appropriate. Survey include questions regarding objectives stated in purpose section.

**Results** 31 Canadian CTS responded to the survey. The average age was 49 years old with average expected retirement age of 63 years of age. Respondents work on average 46 hours per week and 44 weeks per year, with 21% of practice time allocated to corneal transplantation surgeries. 21% of respondents currently offer corneal transplantation fellowship, receiving on average 20 applications per year. Respondents perform on average 1.6 corneal transplantations per week and 60 per year. Approximately half of respondents perform transplants on patients from other provinces and one respondent performs transplants internationally. 14% of respondents currently use precut tissue, while half of respondents believe that using precut tissue would increase the number of transplants they perform and 93% of respondents would take advantage of precut tissue for DSAEK if it was provided by eye banks. 43% of respondents are currently performing ocular stem cell transplantation. Among CTSs that are performing ocular stem cell transplantation, 85% are not currently performing HLA and ABO typing and majority don't plan to start. It was identified that lack of donor tissue is a major cause of corneal transplant surgery being cancelled while lack of operating room time is rarely a problem for most CTSs. However 89% of respondents identified that they would perform more transplants if given more OR time. In the past three years, 94% of respondents saw an increase in number of patients, while majority saw no increase in OR time. Overall respondents have on average 63 patients on their waitlist and lack of donor tissue is identified as the number one reason for waitlist with insufficient OR time in second.

**Conclusions** Recommendations include increase efficiency of distribution of donor tissue between eye banks across the country to increase tissue availability and increasing availability of operating room time for CTSs. Furthermore, Canadian eye banks should consider providing

CTSs with pre-cut donor tissues, especially for DSAEK and more corneal transplantation fellowship positions should be opened nationwide.

## Cornea-Keratoplasty Techniques

Saturday 15 June

### Paper #77

Femtosecond laser assisted penetrating keratoplasty: Analysis of outcomes and comparison of incision morphology

Joshua C. Teichman, Stephanie A. Low, Raneen S. Mashour, Neera Singal, Allan R. Slomovic, David Rootman

**Purpose** To investigate the outcomes of femtosecond laser assisted penetrating keratoplasty and compare the various incision morphologies.

**Study Design** Retrospective cohort study.

**Methods** Retrospective data analysis of all patients who had femtosecond laser assisted penetrating keratoplasty performed at a single centre between 2007 and 2012 with a minimum of 6 months follow-up data. Patient demographic information, procedural information, visual acuity, manifest refraction, corneal topography, re-operations and complications were recorded. Descriptive and inferential statistical analyses were performed.

**Results** Forty-five eyes of 43 patients were included in the study. Preoperative median uncorrected visual acuity (UCVA) was 1.3 (range 0.18 - 3). Median follow-up time was 23 months (range 6 - 68 months). Median UCVA improved to 0.48 (range 0 - 2) postoperatively ( $p < 0.0001$ ). Median manifest sphere was plano (range -10D - 10.5D) and median manifest cylinder was -2.5D (range -9D - 0D). Median mean keratometry was 44.17D (range 35.58D - 49.33D). The three methods used for incisional morphology were tophat, zig-zag, and mushroom configuration. There was a statistically significant difference in postoperative UCVA between zig-zag and tophat morphology ( $p = 0.008$ ) and zig-zag and mushroom morphology ( $p = 0.026$ ), with zig-zag having better postoperative UCVA. The most common reoperations were femtosecond laser assisted astigmatic keratotomy and photorefractive keratectomy. The most common complication was elevation in intraocular pressure. Two patients had graft rejection that was successfully treated with topical medications and two patients had graft failure.

**Conclusions** The visual outcomes of femtosecond laser assisted penetrating keratoplasty were very good and complications were rare. There was statistically significantly better UCVA in those who had zig-zag incision morphology as compared with tophat or mushroom.

## Cornea-Keratoplasty Techniques

Saturday 15 June

### Paper #78

12 Year Review of Evolving Surgical Techniques of and Indications for Corneal Transplantation in Ontario: 2000 to 2012

Angela Qiao Zhang, Darya Rubenstein, Aryeh Price, Elie Côté, Max Levitt, Linda Sharpen, Allan R. Slomovic

**Purpose** To evaluate trends in indications for and preferred surgical techniques of corneal transplantation in Ontario over a 12-year period.

**Study Design** Retrospective review of recipient information forms collected by Eye Bank of Canada (Ontario Division).

**Methods** Database containing information collected from recipient information forms maintained by The Eye Bank of Canada (Ontario Division) was reviewed. Corneal transplants performed between July 1 2000 and June 30 2012 in Ontario were analyzed. Surgeons complete recipient information forms at the time of corneal transplant surgery. Of the 11, 725 available recipient information forms, 10, 906 (93%) were sufficiently complete to meet the inclusion criteria and was included in the study.

**Results** Since 2009, Fuchs' endothelial dystrophy overtook pseudophakic corneal edema as the leading indication for corneal transplantation. Since the shift towards lamellar keratoplasty in 2006, there has been a significant decrease in number of corneal transplants performed with penetrating keratoplasty (PKP) ( $p=0.0016$ ), significant increase in Descemet's stripping automated endothelial keratoplasty (DSAEK) ( $p=0.0069$ ) and Deep anterior lamellar keratoplasty (DALK)( $p=0.0108$ ). The gap between number of PKP and DSAEK performed each year is progressively narrowing. From July 1 2011 to June 30 2012, 514 PKP were performed comparing to 420 DSAEK. From 2011 to 2012, 83% of corneal transplants indicated by Fuchs' endothelial dystrophy were performed with DSAEK, while only 13% were performed with PKP.

**Conclusions** 6 years since initial implementation, partial thickness transplantation continues to rise in popularity. Corneal tissue supply and demand will need to reflect these changes in field of corneal transplantation.

## Cornea-Keratoplasty Techniques

Saturday 15 June

### Paper #79

DSAEK: Endothelial cell loss is greater for Pseudophakic Bullous Keratopathy than for Fuchs' Dystrophy.

Julia C. Talajic, Mark A. Terry, Michael D. Straiko, David Davis-Boozer

**Purpose Purpose:** To determine whether Fuchs' endothelial dystrophy eyes and postsurgical bullous keratopathy (PBK) eyes have differing rates of endothelial cell loss and longterm graft survival following Descemet's stripping automated endothelial keratoplasty (DSAEK).

**Study Design** Retrospective review of prospectively collected data.

**Methods** A review of 854 cases of DSAEK was performed to compare the survival rate and donor endothelial cell loss between eyes with a pre-operative diagnosis of PBK (n=106) versus that of Fuchs' endothelial dystrophy (n=748). Cell loss at 6, 12, and 24 months post-operatively was compared with student t-tests. Long-term survival was compared with Chi Square test.

**Results** The mean cell loss for Fuchs' versus PBK was 25% versus 30% at 6 months (p=.012), 25% versus 30% at 1 year (p=.078), and 26% versus 40% at 2 years (p<0.001). 6 Fuchs' eyes (0.8%) versus 4 PBK eyes (3.8%) experienced late endothelial failure (LEF).

**Conclusions** Postoperative endothelial cell loss is significantly higher for eyes with PBK than those with Fuchs' dystrophy, and LEF occurs at a higher rate among PBK patients. Possible mechanisms to explain these differences in cell loss will be discussed.

## Cornea-Keratoplasty Techniques

Saturday 15 June

### Paper #80

The effects of successful rebubbling of descemet's stripping automated endothelial keratoplasty grafts on primary graft failure and visual acuity: a one-year follow-up.

Uri Elbaz, Elie Côté, Angela Qiao Zhang, Darya Rubenstein, Aryeh Price, Allan R. Slomovic

**Purpose** To examine the effects of successful rebubbling of detached descemet's stripping automated endothelial keratoplasty grafts on primary graft failure and postoperative visual acuity.

**Study Design** Retrospective study

**Methods** A total of 97 consecutive DSAEKs were included in this study. Data was gathered retrospectively from patient charts. Patients were then divided into two groups: those who did not need rebubbling and those who underwent successful rebubbling. Corrected distance visual acuity 6 months and one year postoperatively were compared between the two groups. As well, the proportion of primary graft failures between the two groups was compared.

**Results** Nineteen DSAEKs performed on 19 eyes were included in the successfully rebubbled group, and 76 DSAEKs performed on 73 eyes were included in the non-rebubbled group. Seven primary graft failures were observed in the successfully rebubbled group, compared to 1 primary graft failure in the non-rebubbled group. There were no statistically significant differences in visual acuities between the two groups prior to surgery, 6 months postoperatively or one year postoperatively ( $P=0.89$ ,  $P=0.89$  and  $P=0.35$ , respectively). However, there were a significantly greater proportion of primary graft failures in the successfully rebubbled group than in the non-rebubbled group ( $P<0.0001$ ).

**Conclusions** DSAEK graft rebubbling may be associated with an increased chance of primary graft failure.

## Cornea-Keratoplasty Techniques

Saturday 15 June

Paper #81

Boston Keratoprosthesis type 1: outcomes of bilateral sequential implantation

Paraskevi-Eleni Papanagnu, Raphaelle Fadous, Mona Harissi-Dagher

**Purpose** To describe the indications, complications and possible benefit of sequential bilateral Boston Keratoprosthesis (KPro) type 1 implantation for bilateral corneal blindness.

**Study Design** Retrospective case series.

**Methods** We analyzed 22 eyes of 11 patients who previously underwent sequential bilateral KPro surgery at Centre Hospitalier de l'Université de Montréal (CHUM, Notre-Dame) between October 2008 and October 2011.

**Results** The indication for Boston type 1 KPro was corneal failure in 9 eyes (41%). Preoperative diagnoses were aniridia (54%), lattice dystrophy (9%), HSV keratitis scar (9%), post-traumatic corneal scar (9%), bullous keratopathy (9%) and topical anesthetic keratopathy (9%). Sixteen eyes (72%) had preoperative glaucoma. Median preoperative best-corrected visual acuity (BCVA) was counting fingers (range, 20/150 to LP). The procedures were uneventful in all cases. Mean follow-up was 34 months. Postoperatively, BCVA ranged from 20/20 to 20/150, and 36% of patients saw 20/40 or better at some point in time in the postoperative period. The most common complication was an increase in the intraocular pressure, occurring in 86% of eyes, followed by the development of a retroprosthetic membrane, found in 50% of eyes. At last follow-up, retention rate of the initial KPro was 95%.

**Conclusions** The Boston type 1 KPro is a reasonable option for patients with bilateral corneal blindness and previous keratoplasty failures or a poor prognosis for primary keratoplasty. While additional treatments and procedures are needed for some patients, sequential bilateral KPro surgery had good functional and anatomic outcomes.

## Cornea-Keratoplasty Techniques

Saturday 15 June

### Paper #82

Oral buccal mucous membrane allografts with corneal lamellar grafts for the repair of Boston type 1 keratoprosthesis stromal melts.

Setareh Ziai, Yakov Goldich, David Rootman, Clara C. Chan

**Purpose** One complication of the Boston type 1 keratoprosthesis (Kpro) is stromal necrosis, which can lead to leaks and Kpro extrusion. This paper describes the technique and outcomes of two cases of Kpro corneal melt with backplate exposure that were treated with oral buccal mucous membrane allografts and corneal lamellar grafts.

**Study Design** Retrospective interventional case reports.

**Methods** The charts of two monocular patients with Kpro corneal melt who underwent repair using the following technique were reviewed. Surgical technique involved induction of general anesthesia, followed by retrieval of buccal mucosa from the inner bottom lip. This tissue was thinned and fashioned to the appropriate shape. After closure of the oral wound, an appropriately sized corneal lamellar keratoplasty (LKP) graft was sutured over the area of exposed backplate using nylon sutures. The prepared buccal mucosa was then secured overlying the lamellar graft using interrupted vicryl sutures. Patient demographics, clinical features and outcomes are described.

**Results** Patient A suffered a severe alkali injury in May 2008. After penetrating keratoplasty (PKP) failure, he underwent Kpro implantation (June 2010). Conjunctival retraction around the Kpro optic began in October. Two LKP repairs over exposed areas were attempted before the described procedure was performed 5 times, a mean 3.25 months apart.

Patient B had ocular cicatricial pemphigoid and ectodermal dysplasia. Her Kpro was implanted in 2009 after failed limbal stem cell transplantation and 2 failed PKPs. Between 2009-2011, she underwent 3 LKP repairs for melts. The described procedure was then performed 3 times from 2011-2012, a mean 3 months apart.

**Conclusions** Oral buccal mucous membrane allografts with corneal lamellar grafts may be used to repair Kpro corneal melts. Kpro patients with severe ocular surface disease, chronic conjunctival inflammation and contact lens intolerance are at high risk for complications. Kpro surgeons should be comfortable with the management of Kpro melts.

## Cornea-Keratoplasty Techniques

Saturday 15 June

### Paper #83

Outcomes of the Boston Type 1 keratoprosthesis after failed ocular surface stem cell transplantation for the management of aniridic keratopathy

Mahshad Darvish, Andrea Ang, Clara C. Chan, Edward J. Holland

**Purpose** Aniridic keratopathy is a major cause of vision loss in patients with congenital aniridia. Penetrating keratoplasty is ineffective for the long-term treatment of this disorder because it does not address the limbal stem cell deficiency that is the primary etiologic factor. Ocular surface stem cell transplantation (OSST) has been proposed as a first line therapy for aniridic keratopathy. However, it is susceptible to failure. The role of the Boston Type 1 Keratoprosthesis (KPro) as a treatment for failed OSST was reviewed.

**Study Design** Retrospective chart review.

**Methods** Patients with congenital aniridia who had surgery at a single institution between 1997 and 2012 by a single surgeon were reviewed. Patients treated with OSST who had surface failure and subsequent KPro implantation were selected. Best corrected visual acuities pre-operatively and at the last follow-up visit were recorded. The type of failure and time to failure were also noted.

**Results** 139 eyes in 95 patients with congenital aniridia were evaluated. 12 eyes in 9 patients with failure of OSST and subsequent KPro surgery were reviewed, with a mean follow-up time of 104 months (range: 57 to 132 months). 5 eyes underwent a repeat OSST before the KPro implantation. 7 eyes (58%) had improved visual acuity post-operatively. 7 eyes (58%) also had a visual acuity greater than 20/200. The average time to failure for the OSST was 73 months (range: 28 to 110 months).

**Conclusions** Both OSST and KPro implantation are effective for the treatment of aniridic keratopathy. There are multiple factors that must be taken into account when deciding which modality is most appropriate for treating patients with congenital aniridia. When ocular surface stem cell is selected as a first-line treatment modality, the Boston Type 1 Keratoprosthesis remains a viable option in case of failure.

## Cornea-Keratoplasty Techniques

Saturday 15 June

Paper #84

### Outcomes of Boston Keratoprosthesis Implantation as the Primary Penetrating Corneal Procedure

Samuel Levallois, Marie-Claude Robert, Raphaëlle Fadous, Mona Harissi-Dagher

**Purpose** To evaluate the efficacy and safety of Boston type 1 keratoprosthesis (KPro) surgery as a primary corneal surgery for patients with corneal blindness and poor prognosis for traditional penetrating keratoplasty (PK).

**Study Design** Retrospective comparative study.

**Methods** A chart review of all patients who underwent KPro implantation by a single surgeon (MHD) between October 2008 and March 2011 at the Centre Hospitalier de l'Université de Montréal was performed. Of the seventy eyes (63 patients) included in this study, forty eyes (37 patients) had had previous PK before KPro surgery. Preoperative and postoperative best-corrected visual acuity (BCVA), intraoperative and postoperative complications, and keratoprosthesis retention were examined. Patients with KPro as a primary procedure (group 1) were compared to patients who had PK prior to KPro implantation (group 2).

**Results** There was no difference in baseline preoperative characteristics between the two treatment groups. No intraoperative complications were encountered. Mean follow-up was 26.9 months (range, 13.8-40.9) in group 1 and 29.2 months (range, 13.1-40.9) in group 2. Primary indication for surgery in both groups included aniridia, limbal stem cell deficiency, post-surgical corneal edema (PBK/ABK), neurotrophic keratopathy and infectious keratitis. All patients with chemical burn had prior PK. At 3, 6 and 12 months, BCVA was statistically significantly better in group 1 ( $p < 0.05$ ). At 12 months, BCVA was 0.74 logMAR in group 1 and 1.06 logMAR in group 2 ( $p = 0.025$ ). The complication rates for glaucoma, retroprosthetic membrane, retinal detachment, choroidal hemorrhage, hypotony, uveitis and infection were not significantly different between the two groups. Retention rate was similar in the two groups: 96.7% in group 1 and 97.5% in group 2 ( $p = 1.0$ )

**Conclusions** Boston KPro implantation can be successful as a primary procedure in patients with a high risk of failure for traditional PK. Further prospective studies are needed to validate the efficacy and safety results.

Oculoplastics-2

Saturday 15 June

Paper #85

Experience With Medpor-Coated tear drainage tube : A retrospective chart review

Vasudha Gupta, Ritesh Gupta, Jerrod Kent, Yasser Khan

**Purpose** Lacrimal drainage system obstruction is a common condition encountered in clinical practice. Conjunctivodacryocystorhinostomy (CDCR) with insertion of a bypass tube such as Lester Jones tube is the gold standard treatment for many cases of canalicular obstruction including trauma and canalicular agenesis. The most frequent complication is extrusion with literature rates as high as 49%. Other complications include infection, displacement, corneal abrasion and granuloma formation. Various modifications have been introduced in the tube design in order to minimize complications, including Medpor®, a polyethylene-coated tube. Recent studies have suggested a significant rate of conjunctival irritation and granuloma formation with the use of Medpor® tubes. The purpose of this study is to analyse the outcomes of lacrimal bypass surgery with Medpor® coated tear drainage tube.

**Study Design** Retrospective chart review

**Methods** A retrospective chart review was performed on all patients who had placement of a Medpor®-coated tear drain between 2010 and 2012. The data collected included the age, sex and length of follow-up. Outcomes included patient comfort, and the position and function of tube. Complications were recorded and evaluated.

**Results** A total of 9 patients who had placement of 11 tubes (two bilateral cases) were identified. The mean age was 50 years (range, 9 - 82 years). There were 3 females and 6 males. Follow-up averaged 289 days (range, 82 - 799 days). Five patients had the tube placed as a primary surgery and 4 patients had undergone previous surgeries (DCR or CDCR). Only one case (9%) had extrusion. The most common complications were granuloma formation (n=3, 27%) followed by conjunctival overgrowth (n= 3, 27%). 7 of 9 patients (9/11 cases) reported symptomatic relief.

**Conclusions** Previous studies with Jones tubes have shown high extrusion rates. In our case series, only 1 patient (9%) had extrusion and 9 of 11 cases (82%) reported satisfaction from the procedure with resolution of epiphora. We did find, however, there was an increased rate of granuloma formation and conjunctival overgrowth both of which were easily corrected with

Oculoplastics-2

Saturday 15 June

Paper #86

Probing without Irrigation in Children with Congenital Nasolacrimal Duct Obstruction

Gloria Isaza, Sourabh Arora

**Purpose** To evaluate the results of probing without fluorescein irrigation as primary treatment of congenital nasolacrimal duct obstruction (CNLDO)

**Study Design** Retrospective cohort study

**Methods** The medical records of children who underwent probing without fluorescein irrigation for CNLDO between January 2006 and December 2011 at McMaster University were reviewed retrospectively. Inclusion criteria were: no prior nasolacrimal surgical procedure and at least one of the following clinical signs of CNLDO present: epiphora and/or mucous discharge. Children were investigated in 2 sub-groups based on age at time of probing; group 1 (51 eyes/40 children) was children who underwent probing at age  $\leq 2$  years and group 2 (76 eyes/52 children) was children who underwent probing at age  $> 2$  years. The primary outcome was the complete disappearance of tearing and discharge in the affected eye, assessed one day after surgery and at 3 months after surgery.

**Results** The success rate of probing for the overall sample was 83.5 % (106/127 eyes), in group 1 was 90.2% (46/51) and in group 2 was 78.9% (60/76). There was no significant difference in success rate between groups ( $p=0.094$ ). Gender ( $p=0.292$ ), affected eye ( $p=0.647$ ) and bilateral cases ( $p=0.739$ ) were not associated with successful probing.

**Conclusions** Probing without fluorescein irrigation for CNLDO beyond 1 year of age is highly successful and comparable to the published efficacy rates of the traditional probing with fluorescein irrigation.

## Oculoplastics-2

Saturday 15 June

### Paper #87

Surgical outcome of box-shaped frontalis sling in patients with oculopharyngeal muscular dystrophy

Evan Kalin, Liat Attas-Fox, Sheila Huang, François Codère

Purpose Oculopharyngeal Muscular Dystrophy (OPMD) is an autosomal dominant disorder with symptom onset during middle age. The disease is highlighted by dysphagia and progressive symmetric ptosis. Successful ptosis correction in these patients has been reported using levator advancement, combined aponeurosis-Muller muscle advancement and frontalis sling procedures. Ptosis recurrence is common, particularly if the patient presents at a young age, has borderline levator function and has had retractor advancement operations performed. Two forms of frontalis sling operations performed in our centres include the "modified Crawford" technique and the novel prolene "Box-Shaped" technique. The goal of this study was to compare the outcomes of the Modified Crawford and Box-Shaped frontalis suspension techniques on patients with OPMD.

Study Design This is a retrospective case series of all patients with oculopharyngeal dystrophy that underwent frontalis suspension from 2006-2011 by a single surgeon (Dr. François Codère).

Methods Data including preoperative and postoperative levator function (LF), margin reflex distance (MRD) and palpebral fissure height (PF) were recorded. Intraoperative and postoperative complications, as well as patient demographics were also recorded from all files.

Results Seventy OPMD patients (140 eyes total, 74 Crawford, 66 box) underwent frontalis suspension. Baseline parameters including mean LF (8.6 mm in Crawford group, 8.3 mm in box group) and mean MRD1 (0.4 mm Crawford, 0.2 mm box) were nearly identical in both groups. Mean follow-up was 21 months (range 7-81 months) in the Crawford group and 18 months (range 5-53 months) in the box group. At last follow-up, mean MRD1 increased by 2.8mm in the Crawford group ( $p < 0.0001$ ) and 2.6mm in the box-shaped group ( $p < 0.0001$ ). Asymmetry was noted in 8 eyes (4 in each group) and lid contour irregularity in 7 eyes (3 eyes Crawford, 4 eyes box). Ptosis recurred in 14 eyes (7 in each group). Suture abscess occurred in 1 eye (Crawford), significant SPK in 2 eyes (1 eye Crawford, 1 eye box) and no significant lagophthalmos was noted.

Conclusions The box-shaped frontalis suspension technique, although technically less demanding and less time consuming to perform, yields similar results to the modified Crawford technique. We advocate using either frontalis suspension technique in patients with OPMD earlier than with other forms of myogenic ptosis due the progressive nature of the disease.

Oculoplastics-2

Saturday 15 June

Paper #88

Small Incision Lid Lengthening (SILL) Technique for Upper Eyelid Retraction

Jerrod Kent, Yasser Khan

**Purpose** Upper eyelid retraction is a common finding in Thyroid Eye Disease (TED). Many different approaches for lid lengthening have been documented, including the current mainstay - graded full-thickness blepharotomy. We describe a new, modified, small incision technique for upper eyelid lengthening in lid retraction associated with TED.

**Study Design** New / novel technique description. Retrospective Study.

**Methods** Patients with TED and upper eyelid retraction were identified pre-operatively. Pre-operative eyelid measurements (MRD1) were recorded. SILL was performed on these patients. A small (5-7 mm) central incision is made at the skin crease and full thickness dissection is carried out through conjunctiva. Lid height is assessed intra-operatively and can be adjusted through further dissection deep to the skin, while maintaining the small skin incision. The minimal incision is closed with 2-3 interrupted sutures.

**Results** The techniques will be described with photos and videos. Patients are seen in follow up at 1 week and 3 months. Through the small incision, scarring is minimal and intra-operative discomfort is reduced when compared to large, full-thickness blepharotomy. MRD-1 values were considerably decreased in all cases and patients had acceptable upper eyelid contours. Post-operative scarring was minimal.

**Conclusions** Although graded full-thickness blepharotomy remains the mainstay of treatment for TED, SILL provides a minimally invasive technique with minimal post-operative scarring and recovery. SILL offers predictable, reproducible results and is a simple and quick surgical procedure to master.

## Cornea-Challenging Cases in Cornea & Refractive Surgery

Saturday 15 June

Paper #89

Clinicopathological case reports of *Alternaria* and *Fusarium* keratitis in Canada

Kailun Jiang, Seymour Brownstein, Kashif Baig, Kay Lam, Baldwin Toye

Purpose Herein, we present two cases of fungal keratitis that rarely are found in Canada. Both patients were farmers who acquired the condition through chemical trauma and contact lens usage respectively. One of the cases was the first report of *Alternaria alternata* keratitis in Canada, while the second patient had *Fusarium* keratitis.

Study Design Case series from a single clinical setting.

Methods Report of two cases of fungal keratitis submitted to the University of Ottawa Ophthalmic Pathology Laboratory with a literature review.

Results Following an alkaline corrosive corneal ulcer, our first patient was managed with broad-spectrum antibiotics and a keratoprosthesis. Filamentous fungi were identified in the excised corneal tissue and corneal cultures grew *Alternaria alternata*. Despite aggressive treatment with topical and oral antifungal medications along with collagen crosslinking, the corneal tissue around the keratoprosthesis developed an infectious melting process. Following explantation of the keratoprosthesis and a wide sclerokeratoplasty, the eye developed endophthalmitis and became phthisical. The second patient was a contact lens wearer who presented with a *Fusarium* corneal ulcer of 10 days duration, which did not improve with topical and oral antifungal medications and which also did not stabilize with collagen crosslinking. The cornea perforated and his condition eventually improved following a penetrating sclerokeratoplasty and perioperative intracameral and topical voriconazole.

Conclusions Geography strongly influences the prevalence of fungal keratitis in North America. An estimated 35% of all keratitides in Florida result from fungal infections while this number drops to 2% in more temperate areas such as New York and Canada. To our knowledge, there has been no reported case of fungal keratitis with *Alternaria* species above the 42°N latitude in North America. Thus, our first patient is the only reported case of *Alternaria* keratitis in Canada. Our two cases emphasize the importance of maintaining a high index of suspicion for fungal keratitis, especially in high-risk situations. Since both *Alternaria* and *Fusarium* species are common crop pathogens in North America, it is important that farmers and physicians be aware about this potential hazard of fungal keratitis, so that they may try to minimize its occurrence and be treated appropriately in a timely manner.

## Cornea-Challenging Cases in Cornea & Refractive Surgery

Saturday 15 June

Paper #90

Comparison of fibrin glue and autologous blood for conjunctival autograft fixation in pterygium surgery

Sophie Boucher, Salina Teja, Kashif Baig

**Purpose** There are numerous techniques in pterygium excision surgery that produce varied results in wound healing and pterygium recurrence. Our purpose is to investigate the use of a novel technique, graft fixation with autologous blood, by comparing its anatomic and visual outcomes to those obtained with fibrin glue in pterygium excision surgery.

**Study Design** Retrospective comparative case series.

**Methods** This is a retrospective comparative case series of patients with a primary nasal pterygium who underwent excision. All patients had a conjunctival autograft from the superior bulbar conjunctiva to cover the scleral bed. 17 patients had fixation of the autograft with autologous blood (AB) and 17 patients had fixation with fibrin glue (FG). Data was collected up to 6-months post-operatively and included; surgical cost and time, conjunctival graft stability and healing, visual acuity and pterygium recurrence. Outcomes were compared between the two groups and assessed for statistical significance with a paired student t test.

**Results** Of our 34 patients, 15 were female and 18 were male with a mean age of 52. The mean size of conjunctival autograft was 36mm<sup>2</sup> in the AB group and 42mm<sup>2</sup> in the FG group. There were no intra-operative complications in either group. Surgical costs differed in each group: the FG group incurred the cost of the fibrin glue whereas the AB group had the additional costs associated with an extra 15 minutes of procedure time. At 1-month post-operatively, 4 patients in the AB group had lost their graft compared to zero in the FG group, showing greater stability in the FG group. Mild graft displacement was seen in 3 patients in each group. The visual acuity was stable in both groups. There was no incidence of pterygium recurrence in either group. 6-month follow up outcomes will be analyzed by March 2013.

**Conclusions** Pterygium recurrence rates vary due to many factors including surgical technique. The conjunctival autograft fixated with autologous blood has been shown to be safe and effective but its role is not well established. The fibrin glue technique is widely used but poses a risk of hypersensitivity reactions, discomfort, scarring and infection. Our preliminary results show that fixation with autologous blood produces similar visual and pterygium recurrence outcomes to fibrin glue fixation, however seems to have less stable grafts at follow up. Our comparison of the efficacy and stability of the conjunctival autograft between the two techniques at 6 month follow up will help to further establish the role of autologous blood in pterygium surgery.

## Cornea-Challenging Cases in Cornea & Refractive Surgery

Saturday 15 June

### Paper #91

A comparison of techniques for corneal tattoo: Intrastromal micropuncture versus intrastromal lamellar pocket

Laura Segal, Michele Mabon, Johanna Choremis

**Purpose** Corneal tattoo is a known treatment of diplopia secondary to laser peripheral iridotomy. The purpose of this study is to compare the efficacy and tolerance of traditional intrastromal micropuncture (IM) versus the new technique of intrastromal lamellar pocket (ILP) in order to perform corneal tattoo.

**Study Design** Retrospective comparative study

**Methods** Study performed on 12 eyes of 10 consecutive patients that had undergone either type of corneal tattoo in order to treat diplopia, halos and glare secondary to laser peripheral iridotomy. Patients were contacted in the post-operative period and questioned in order to assess global satisfaction with regards to resolution of symptoms, presence of post-operative irritation, and number of retreatments necessary.

**Results** There were five patients who underwent ILP, and seven patients who underwent IM. All patients in both groups noticed some degree of improvement in their symptoms, ranging from 10% to 100%. In the ILP group, 2/5 patients had a significant improvement in symptoms and 3/5 had a mild improvement in symptoms. Whereas in the IM group, 6/7 patients had a significant improvement in symptoms and 1/7 had a mild improvement in symptoms. However, the number of retreatments was higher in the IM group. Post-operatively, all patients complained of mild irritation and/or photophobia, lasting from two days to two weeks.

**Conclusions** Corneal tattoo appears to be a simple, effective, well-tolerated technique in order to treat symptoms secondary to laser peripheral iridotomies. While there does not appear to be a statistically significant difference in efficacy between the two techniques described, a longer-term and larger study would be necessary to further investigate this issue.

## Cornea-Challenging Cases in Cornea & Refractive Surgery

Saturday 15 June

Paper #92

"Gone fishing": case series and review of mucus fishing syndrome

Silvia Odorcic, W. Bruce Jackson

**Purpose** To report two cases of mucus fishing syndrome (MFS), a challenging and often overlooked condition caused by repetitive mechanical trauma to the conjunctival epithelium through patient extraction of mucus strands from the ocular surface.

**Study Design** Case series (n=2) and literature review.

**Methods** Two patients were referred for complaints of increased mucus production and ocular irritation. Their clinical course and management of their MFS is reviewed. Video clips of both patients demonstrating their preferred techniques for mucus extraction are presented.

**Results** Aside from mild keratoconjunctivitis sicca, both patients had normal ocular exams with minimal staining of either cornea or conjunctiva. Upon further questioning, patients admitted to extracting mucus from their ocular surface several times a day. Techniques included forcefully fishing mucus from the superior and inferior fornices or touching the ocular surface with a pointed tissue. Patient education was combined with the use of an antihistamine and 10% N-acetylcysteine to help break the cascading cycle and encourage resolution of symptoms.

**Conclusions** Mucus fishing syndrome (MFS) is a cyclical process whereby patients extract or "fish" mucus from the ocular surface that is produced in response to ocular irritation. Common initiating irritants include keratoconjunctivitis sicca, allergic conjunctivitis or blepharitis but patients may also present with a normal ocular exam. Once initiated, digital mucus extraction only further intensifies mucus production. MFS is diagnosed based on the patient's admission of physically extracting mucus, which is often corroborated by a characteristic staining pattern corresponding to the area of ocular surface insult. Treatment involves breaking the cycle of mucus extraction while addressing the underlying irritant. Anti-histamine/mast cell stabilizers and mucolytic agents combined with patient education are useful methods of breaking this vicious cycle.

## Cornea-Challenging Cases in Cornea & Refractive Surgery

Saturday 15 June

### Paper #93

Ocular manifestations of Stevens-Johnson syndrome and toxic epidermal necrolysis syndrome in children.

Caroline Catt, Kamiar Mireskandari, Asim Ali

**Purpose** Stevens-Johnson syndrome (SJS), toxic epidermal necrolysis syndrome (TENS) and overlap syndrome (SJS/TENS) are rare but serious mucocutaneous diseases with potentially devastating ocular sequelae, and with little information in the current literature about their acute and long-term ocular manifestations in children. The purpose of this study is to describe the clinical features and severity of ocular involvement in the inpatient phase of these disorders in a paediatric population.

**Study Design** This is a retrospective cohort study of all children admitted to the Hospital for Sick Children (Toronto, Canada) with a diagnosis of SJS, TENS, or SJS/TENS between June 1st 2001 and June 1st 2011.

**Methods** Demographic information, clinical findings at every ocular examination since admission and visual acuity outcomes were obtained from medical records.

**Results** Thirty-six patients were identified for inclusion (20 SJS, 9 SJS/TENS, 7 TENS). Ocular involvement was acutely present in 80.6% (75% SJS, 77.8% SJS/TENS and 100% TENS) of patients. It was severe in 13.9% of all patients, moderate in 36.1% and mild in 30.6%. Ocular disease was symmetrical in 91.7%. The earliest post-admission visual acuity in the better eye during the inpatient phase was 20/40 or better in 61.1% of all patients and between 20/50 and 20/200 in 8.3%. Quantifiable visual acuity measurements were not available for almost a third of all patients (30.6%). Conjunctivitis and conjunctival epithelial defects were the most common ocular manifestations during the inpatient phase. Conjunctival membranes and corneal epithelial defect affected a third of all patients with ocular involvement. Corneal melting and opacification were observed in one patient each during the inpatient phase and three patients required amniotic membrane graft surgery.

**Conclusions** Most paediatric patients with SJS, SJS/TENS or TENS have ocular involvement in the acute, inpatient phase of the disease. In 13.9% of all patients there is sight-threatening involvement. Careful and frequent assessment during the inpatient phase can direct management and minimize the chance of long term ocular sequelae.

## Cornea-Challenging Cases in Cornea & Refractive Surgery

Saturday 15 June

Paper #94

Traumatic bilateral LASIK flap dislocation

Ananda Kalevar, Dev Cheema

**Purpose** To report the first case of a patient who developed bilateral corneal flap dehiscence 2 years after LASIK following facial trauma.

**Study Design** Retrospective chart review of a patient.

**Methods** Clinical presentation, mechanism of injury, complications, treatment and outcome were studied. Review of published cases on LASIK flap dislocation was performed.

**Results** Case involved a 41-year-old man who dislocated both his flaps after being hit to face by a fist 2 years after LASIK. Uncorrected visual acuity was 20/400 OD and 20/200 OS. Bilaterally, flap dislocation, epithelial ingrowth and significant macrostriae were seen. Immediate surgical lift of both flaps with removal of the epithelium ingrowth from the stromal beds was completed. The flaps were refloated and repositioned and bandage contact lens were used along with topical medication. Final BCVA was 20/20 OD and 20/25 OS, with mild microstriae and mild focal areas of epithelial ingrowth OU.

**Conclusions** Flap dehiscence is a rare complication of LASIK. Several case reports have been published that demonstrate that tangential force applied to eyes having undergone LASIK years ago can dislocate. However, this is the first case report to have traumatic flap dislocation bilaterally years after surgery.

## Cornea-Challenging Cases in Cornea & Refractive Surgery

Saturday 15 June

Paper #95

Traumatic secondary corneal amyloidosis.

Joshua S. Manusow, Seymour Brownstein, Kay Lam, Andre Jastrzebski, George Mintsioulis, Steven Gilberg, Joseph Sassani, W. Bruce Jackson

**Purpose** To report on 5 cases of corneal amyloidosis secondary to prior perforating trauma

**Study Design** Retrospective clinical histopathological correlation

**Methods** Retrospective review of the clinical and surgical histories of five patients with traumatic secondary corneal amyloidosis. Three patients underwent penetrating keratoplasties, and two patients underwent evisceration. The histopathologic features of all five corneas are reviewed.

**Results** Four patients had a history of non-surgical trauma and one patient had a history of surgical trauma. All specimens showed full thickness scars associated with congophilic amyloid deposits that exhibited dichroism and apple-green birefringence under polarized light. Of the 3 specimens undergoing immunohistochemistry, all 3 showed the presence of amyloid AP, but not AA or AL amyloid.

**Conclusions** Secondary localized corneal amyloidosis with the presence of AP amyloid is a rare sequela of surgical and nonsurgical perforating trauma.

## Cornea-Challenging Cases in Cornea & Refractive Surgery

Saturday 15 June

Paper #96

Cystic lesions of the iris: techniques and outcome of surgical excision and iris reconstruction.

Toby Chan, Iqbal Ike K. Ahmed

**Purpose** Iris cysts are rare non-malignant lesions that may lead to corectopia, anterior uveitis, intraocular lens implants (IOL) tilt, and anterior chamber angle closure resulting in intraocular pressure (IOP) rise. In these scenarios, excision may be indicated, which often results in a significant defect that requires reconstruction. Our goals are: 1) to review the anterior segment imaging of iris cysts; 2) to describe techniques and outcome of excision and iris reconstruction in patients with iris cysts.

**Study Design** Small retrospective interventional case series.

**Methods** Consecutive cases of iris cysts over the past 3 years were reviewed. Slit lamp photos were taken pre- and post-operatively to document the lesion size and post-operative appearance. Corneal endothelial cell count using specular microscopy (ECC) overlying the lesion was recorded pre-operatively. Anterior segment imaging using anterior segment optical coherence tomography (AS-OCT: Visante®) and ultrasound biomicroscopy (UBM) were performed before and after surgery. Surgical videos were reviewed.

**Results** 3 cases were identified, all involving the inferior iris. Subject #1 presented with a cystic lesion of 5.3 x 7.2 mm, resulting in dyscoria and patient's concerns of cosmesis. Subject #2 had an iris cyst measuring 7.0 x 2.0 mm, with symptoms of photosensitivity and monocular diplopia. Subject #3 had iris cyst of 8.8 x 4 mm, with slight IOL tilt and complaint of blurred vision. In all cases, AS-OCT and UBM findings suggested a cystic lesion within the iris stroma. ECC was unremarkable for all subjects. Excision was performed using micro-scissors cutting around the lesion's margin. Endoscopic photocoagulation laser was applied to the edge of the resulting iris defect, and to ciliary processes directly behind the lesion. 10-0 polypropylene sutures were placed to appose the iris edges in a simple interrupted manner using a modified McCannel technique. Post-operatively all 3 patients had a round pupil and were satisfied with the cosmetic outcome. Repeat AS-OCT and UBM confirmed complete excision of the cystic lesions. Subject #2 had IOP spike to 49 mmHg at 2 weeks post-operatively, likely due to steroid response, which resolved after tapering off dexamethasone drops. No acute complication was noted in the other subjects. Pathology confirmed iris cyst with finding of conjunctival epithelial ingrowth in all cases.

**Conclusions** AS-OCT/UBM can help with the diagnosis, characterization, and confirmation of complete excision of iris cysts. Our techniques of biopsy and iris reconstruction for this rare lesion produced satisfactory post-operative results.

Oculoplastics-3

Saturday 15 June

Paper #97

Vismodegib for periocular and orbital basal cell carcinoma.

Harmeet S. Gill, Eve E. Moscato, Anne Chang, Rona Z. Silkiss

**Purpose** This is a pilot study to determine the feasibility of using vismodegib for periocular and orbital basal cell carcinoma (BCC) based on its efficacy and tolerability.

**Study Design** Prospective interventional cohort study.

**Methods** Consecutive patients with periocular or orbital BCC that met criteria for treatment with vismodegib were recruited prospectively over a six-month period from February 2012 through September 2012 from two academic hospitals. Seven patients received oral vismodegib 150mg daily until maximum clinical response was achieved, the tumor progressed, or the patient could no longer tolerate adverse effects. The clinical response and adverse effects related to treatment were recorded for all enrolled patients. The primary endpoint was reduction in lesion size, measured as percentage change in the externally visible dimension.

**Results** All seven patients had locally-advanced, biopsy-proven infiltrative BCC that was not amenable to surgical resection or radiation. No patients had metastatic disease at presentation. Mean patient age was 71 years (range 43 to 100) and four patients (57%) had secondary orbital involvement. Mean lesion size was 3.4 cm (range 1.0 to 6.0) and all seven cases (100%) represented recurrent tumors excised previously with controlled margins by frozen section or Mohs' micrographic surgery. Mean treatment duration was 11 weeks (range 4 to 16) and mean duration of follow-up was 9.3 months (range 2 to 10). During follow-up, two patients (29%) demonstrated complete clinical regression, two (29%) demonstrated greater than 80% partial clinical regression, two (29%) demonstrated less than 35% partial clinical regression, and one (14%) progressed. Adverse reactions occurred in six patients (86%) and included alopecia (29%), dysgeusia (29%), muscle cramps (29%), and anorexia (14%). Two patients (29%) developed new squamous cell carcinomas (well-differentiated, keratoacanthoma type) at uninvolved sites including the eyebrow and forearm.

**Conclusions** Vismodegib seems to be well-tolerated and effective for treating periocular and orbital basal cell carcinoma in about half of all cases. Patients receiving treatment should be monitored for new squamous cell carcinomas at uninvolved sites.

Oculoplastics-3

Saturday 15 June

Paper #98

The Effects of Size of Hard Palate Mucosal Grafts on Posterior Lamellar Grafting for Treatment of Lower Lid Retraction

Sonul Mehta, James Oestreicher

**Purpose** Lower lid retraction is often a common problem associated with thyroid related eye disease, post-blepharoplasty, trauma, or idiopathic. One of the mainstays of treatment is use of autologous graft tissue from the hard palate of the mouth, combined with lower lid elevation and retractor recession. To date, the effect of the size of this graft on lower lid elevation in patients who suffer from lagophthalmos, scleral show, and corneal exposure secondary to this condition is ill-defined.

**Study Design** Retrospective chart review

**Methods** Prior to placement of the graft into the lower lid, the size of the elliptical graft that was harvested was measured in millimeters (length and width). The cause for lower lid retraction, any complications that occurred with the procedure, demographics were recorded for each patient.

**Results** Pre-operative and postoperative measurements included the following:

- a. amount of scleral show (in mm)
- b. amount of lagophthalmos (in mm)
- c. presence of superficial punctate keratopathy or SPK (graded scale 0-3, 0 representing no SPK, 3 = diffuse SPK)
- d. subjective patient symptoms (pre-operative and post-operative gritty sensation, foreign body sensation, and dry eye)

The patients were divided into two groups, grafts less than 6 mm in width, and those larger. The groups were compared with regard to outcomes.

**Conclusions** The results of this study will help guide surgeons in the selection of graft size for the best possible results when hard palate mucosal grafts are used for the treatment of lower lid retraction.

## Oculoplastics-3

Saturday 15 June

### Paper #99

Fixation of extraocular muscles to porous orbital implants using cyanoacrylate glue in patients undergoing enucleation.

Daniel Warder, Vladimir Kratky

**Purpose** The purpose of this study is to demonstrate an alternative and faster method of fixating extraocular muscles directly to spherical bioceramic implants.

**Study Design** Prospective interventional case series

**Methods** All patients undergoing enucleation at Queen's University oculoplastics service from October 2011 to May 2012 received primary implantation of an aluminum oxide orbital implant (Bioceramic, FCI Ophthalmics) with the 4 recti muscles being fixed directly to the implant with octyl-cyanoacrylate glue (DermaBond, Ethicon). Functional assessment was done by clinical observation and measurement of implant ductions at 3 weeks and at least 6 months postoperatively. Structural assessment of the muscle-implant bond was achieved with orbital CT scans. Implant motility in this group of patients was compared to a cohort of enucleation patients whom had received the standard suture-fixation technique to a Vicryl mesh wrap of the implant.

**Results** 10 patients received octyl-cyanoacrylate fixation of their rectus muscles to a bioceramic orbital implant during enucleation. There were no complications intraoperatively or postoperatively except for one patient who developed wound dehiscence with implant exposure, however this was felt to be due to chronic alcoholism with liver failure and poor wound healing. 6-month postoperative assessments demonstrated adequate implant motility in all 4 directions of gaze with no significant difference in measured ductions compared to the sutured cohort. Orbital CT scans showed excellent anatomical relationship of rectus muscles to implants.

**Conclusions** Fixation with octyl-cyanoacrylate glue is an effective way to directly attach rectus muscles to porous orbital implants during enucleation surgery. In this small cohort, adequate functional and structural results were achieved, with implant motility similar to traditional sutured implants. This technique has the potential to lower procedure costs by reducing the number of sutures and eliminating the need for wrapping material. The operating time is also significantly reduced by this technique.

Oculoplastics-3

Saturday 15 June

Paper #100

Optic Neuropathy in Thyroid Eye Disease : What Are the Results of the Combined Medial and Lateral Decompression Technique ?

Catherine Baril, Yvonne Molgat, Denis Pouliot

**Purpose** To determine the efficacy of combined endoscopic medial and external lateral orbital decompression for the treatment of compressive optic neuropathy (CON) in thyroid eye disease (TED).

**Study Design** A retrospective review of all patients undergoing combined surgical orbital decompression for CON between 2000 and 2010 was conducted.

**Methods** Sixty-two eyes of 35 patients were included in the study. Clinical outcome measures included visual acuity, Hardy-Rand-Rittler (HRR) color plate testing, relative afferent pupillary defect, intraocular pressure measurement and Hertel exophthalmometry. A CON score was calculated preoperatively and postoperatively based on the visual acuity and the missed HRR plates. A higher CON score correlates with more severe visual dysfunction.

**Results** All patients had improvement of their optic neuropathy after surgical decompression. CON score was calculated for fifty-four eyes and decreased significantly from a mean of  $13,2 \pm 10,35$  preoperatively to a mean of  $7,1 \pm 10,24$  postoperatively ( $p < 0.0001$ ). Optic neuropathy was completely resolved in 93,55% (58 of 62 eyes). Eighteen of 35 patients (51,43%) developed new-onset postoperative strabismus requiring subsequent surgical correction.

**Conclusions** Endoscopic medial combined with external lateral orbital decompression is very effective for the treatment of thyroid eye disease-associated compressive optic neuropathy.

Oculoplastics-3

Saturday 15 June

Paper #101

Is there still a role for surgery in the management of orbital lymphangiomas?

Babak Maleki, François Codère

**Purpose** To investigate the role of surgical debulking, complete surgical removal and percutaneous injection of sclerosing agents in the management of orbital lymphangiomas

**Study Design** This is a retrospective review of all cases of orbital lymphangiomas referred to Halifax, Nova Scotia from 2010-2012. Primary outcome measures include visual acuity, pupillary function and exophthalmometry readings. Secondary outcome measures are the subjective appearance of the lids and orbit.

**Methods** One case was managed with observation, one with surgical debulking, one with surgical excision using a fibrin glue. The fourth case was managed with injection of a sclerosing agent.

**Results** Injection of sclerosing agents caused a reduction in the overall volume of the lymphangioma, improving proptosis and subjective appearance. Injection of Tisseel helped in the dissection allowing complete excision, improving both visual acuity and appearance.

**Conclusions** Intralesional injection of a fibrin glue is an effective adjunctive treatment of lymphangiomas, and can be used for complete excision of small to medium sized lesions. Percutaneous sclerosing therapy is better for shrinking larger lesions and those unamenable to surgery.

Oculoplastics-3

Saturday 15 June

Paper #102

Late-onset periocular soft tissue mass secondary to hyaluronic acid fillers: report of three cases

Nawaaz A. Nathoo, Steve Rasmussen, Peter J. Dolman, David Rossman

**Purpose** To describe 3 patients with periorbital soft-tissue swelling masquerading as more serious pathology, ultimately confirmed as a delayed-onset reaction to hyaluronic acid filler use.

**Study Design** Retrospective case series.

**Methods** A retrospective chart review of cases presenting to the ocular pathologist with soft-tissue swelling consistent with hyaluronic acid filler.

**Results** Three cases are presented, all with varying clinical presentations, demonstrating delayed-onset swelling, with or without granulomatous inflammation, consistent with remote hyaluronic acid filler use.

**Conclusions** Delayed-onset soft-tissue swelling in response to hyaluronic acid filler, distant in time and injected location on the face, can masquerade as more serious pathology in the peri-orbital region. Patients may be hesitant to share their history of filler use and it is important for the consulting ophthalmologist to be aware of this bothersome reaction so as to adequately recognize it and investigate and treat accordingly.

Pediatrics: Strabismus

Sunday 16 June

Paper #103

The Prevalence of Infantile Esotropia in Children of Chinese Descent

Maria D. Gonzalez-Diaz, Agnes Wong

**Purpose** The prevalence of strabismus varies according to the population studied, ethnicity, and geographic area. Previous studies in Asian population have found that, unlike those in western countries, esotropia is much less common (2.5x) than exotropia. Because of the homogeneous nature of the population studied, however, it is difficult to ascertain whether there is a real difference in the epidemiology of strabismus among ethnic groups. The aim of the study is to determine the prevalence of a subtype of esotropia, infantile esotropia (IET), in otherwise healthy cohort of Chinese and non-Chinese children referred to a tertiary eye center in a large urban center in North America that serves a ethnically-diverse population of over 8 million.

**Study Design** A retrospective chart review was conducted on patients referred for possible IET between January 2004 and June 2012.

**Methods** Demographic data including gender, age at referral, family history of strabismus or IET, medical history, refractive error, final diagnosis, and strabismus surgery history were recorded. Patients were classified as Chinese and non-Chinese based on their last names. Analysis of last names has been used in epidemiology and population-based studies to identify people of Chinese origin with a sensitivity of 92% and specificity of 80%.<sup>1,2</sup> Patients who were referred after age 2 years of age or those with comorbidities (e.g., low birth weight, prematurity, neurological disorders, Down syndrome, developmental delay) were excluded. Patients were divided into two groups based on the final diagnosis: IET and no IET.

**Results** Two hundred and fifty-six patients were included in the analysis. There were 20 (7.8%) patients of Chinese descent and 236 (92.2%) of non-Chinese decent. Of these 20 children, only one was diagnosed with IET, giving a prevalence of IET of 5.0% (1/20) in patients of Chinese descent. IET was diagnosed in 129 patients of non-Chinese descent, giving a prevalence of IET of 54.6% (129/236), which is significantly higher than that in Chinese patients (Fisher's exact,  $p < 0.001$ ).

**Conclusions** The prevalence of IET is significantly higher in healthy patients of non-Chinese descent (54.6%) than those of Chinese descent (5.0%).

With growing global immigration, the ethnic composition of developed countries will continue to change. Improved understanding of racial variations in epidemiology and disease features will allow us to better serve our increasingly diverse population.

## Pediatrics: Strabismus

Sunday 16 June

### Paper #104

Factors affecting stereopsis after surgical alignment of acquired partially accommodative esotropia.

Yiannis Iordanous, Inas Makar

**Purpose** Factors influencing stereopsis outcomes have been reported for infantile esotropia, refractive accommodative and nonaccommodative esotropia. Similar studies for acquired partially accommodative esotropia (APAET) that requires surgical alignment are scarce. The purpose of this study was to determine factors that may affect stereopsis in patients with APAET.

**Study Design** Retrospective chart review.

**Methods** We retrospectively reviewed the charts of all patients diagnosed with APAET who underwent successful strabismus surgery (postoperative motor alignment  $<8$ PD) performed before the age of 10 years. All patients were from a single surgeon's practice at the Ivey Eye Institute (St Joseph's Health Care, London, Ontario). We examined various factors which may influence postoperative stereopsis, including age of onset (AO), age at referral, duration of misalignment and age at surgery. We compared the influence of these factors on developing stereopsis measuring 100 seconds of arc or better postoperatively. A backward elimination algorithm was conducted to identify the independent risk factors that significantly affect stereopsis outcome. The factors included in this regression were selected based on a preliminary unpaired t-test.

**Results** 48 patients met our inclusion criteria. Nineteen (40 percent) had a final stereopsis of 100 seconds of arc or better. The mean AO for patients achieving post-operative stereopsis was 33.5 months, versus 25.1 months ( $p=0.01$ ) for the group not attaining stereopsis. The mean age at referral for patients achieving post-operative stereopsis was 60.5 months, versus 44.2 months ( $p=0.01$ ) for the group not attaining stereopsis. The mean age at surgery for patients achieving post-operative stereopsis was 72.1 months, versus 55.8 months ( $p=0.01$ ) for the group not attaining stereopsis. The backward elimination regression analysis found older age at surgery to be the only predictive factor for obtaining post-operative stereopsis measuring 100 seconds of arc or better (OR 1.022, 95% CI 0.99 - 1.56).

**Conclusions** For patients with APAET, older age at surgery was correlated with a higher likelihood of achieving postoperative stereopsis. Children achieving postoperative stereopsis also tended to be older at both onset of the deviation and initial referral.

Pediatrics: Strabismus

Sunday 16 June

Paper #105

Surgical treatment of adult exotropia: target angles and adjustable suture strategies.

Emmanuelle Chalifoux, Maan Alkharashi, Michael E. Flanders, Rosanne Superstein, Mélissa Louis, Claire Blais, Shamim Sabzevari

Purpose 1) To characterize clinical profiles of adults with consecutive (CXT), intermittent (IXT) and sensory (SXT) exotropia; 2) To establish immediate, postoperative target angles that maximize long term ocular alignment; 3) To compare the efficacy of adjustable vs non-adjustable medial rectus advancement-resection.

Study Design Retrospective, observational and interventional cohort study

Methods Sixty adult, exotropic patients were treated surgically at the Montreal General, Jewish General and Notre Dame Hospital centers between July 2012 and November 2012. (Projected number of subjects in study by April 2013 =120). All patients were divided into clinical profiles (CXT, IXT and SXT) based on ophthalmic and orthoptic assessments. Two treatment groups were established: Group I: adjustable medial rectus advancement-resection and adjustable lateral rectus recession; Group II: non-adjustable medial advancement-resection and adjustable lateral rectus recession. Measurements of immediate post-adjustment alignment (target angle), and 3-6 month follow-up alignment were performed. Surgical success was defined as distance, primary position alignment within 10 prism diopters of orthotropia 3-6 months post-operatively.

Results Comparison of clinical groups showed that: CXT patients had more hyperopia and amblyopia, more previous surgeries and smaller preoperative deviations; IXT patients had more diplopia and larger preoperative deviations (near>distance); SXT patients had poor vision in the deviating eye and larger preoperative deviations. Average distance, preoperative and immediate postoperative deviations (prism diopters, PD) in CXT was XT 29, ET 6; IXT: XT 38, ET 8; and SXT: XT 39, ET 03 respectively. The immediate post-op measurements represent target angles. Average distance deviations (PD), 2 weeks post-op, in CXT was ET 1; IXT, XT 0; and SXT, XT 4. A successful outcome in the early follow-up period was achieved in 94% of CXT patients, 92% of IXT patients and 83% of SXT patients. There were no significant differences between the adjustable and non-adjustable medial rectus surgery groups in the immediate or 2 week postoperative periods.

Conclusions Three clinically distinct types of surgically treated, adult exotropes were studied in order to establish target angles that would optimize long term ocular alignment. Early postop results show excellent outcomes. Adjustable vs non-adjustable medial rectus strategies are equally successful. Analysis of a larger cohort with longer follow-up will be available at the time of this presentation.

## Pediatrics: Interesting Cases & Practice Assessment

Sunday 16 June

Paper #106

Paediatric Ophthalmology Sedation Unit: A safety and effectiveness analysis of 1509 cases

Kamiar Mireskandari, Stephanie West, Beverley Griffiths, Yasmin Shariff, Derek Stephens

**Purpose** Chloral hydrate (CH) sedation is a cost effective alternative to general anesthesia for pediatric patients who are unable to cooperate with detailed ophthalmic examination. We report the largest study on the safety and effectiveness of sedation in paediatric ophthalmology in a nurse lead outpatient sedation unit.

**Study Design** Retrospective chart review.

**Methods** All children who underwent sedation from January 2006 to December 2010 were included. Patients were sedated with 80mg/kg of chloral hydrate given orally with top up dose given at half dose as required. All demographic data, sedation and procedure duration, sedation success and adverse events were recorded. Univariate and multiple regression analysis was performed to assess factors associated with success and complications.

**Results** Data was collected for 1509 sedation episodes. More males were sedated compared to females (56.3% vs 43.7%  $p=0.0003$ ) with an average age of 23.85 months and weight of 11.76kg. There were more patients with mild systemic disease; American Society of Anaesthesiologists (ASA) score 2 in our cohort than healthy children with ASA score 1 (58.5% vs. 41.5%,  $p=0.0001$ ). Successful sedation was obtained in 96.7% of children with 4.77% requiring a top up dose to achieve this. The average sedation duration was 53 minutes ( $SD=21.5$ ) with an average of 1.66 procedures performed; the commonest being a detailed examination (93%) and electroretinogram (27%). Adverse events included paradoxical reaction (1.33%), desaturation (0.99%) and vomiting (0.53%). There were no serious complications or hospital admission.

Multiple logistic regression analysis found weight greater than 15kg and needing a top up dose to be significant risk factors for Failure ( $OR=2.38$  and  $2.09$  respectively) and Adverse events ( $OR=8.45$  and  $3.97$  respectively). Sex and ASA score did not significantly affect outcomes.

**Conclusions** Chloral hydrate sedation allows detailed examination and investigations in the majority of children with few side effects. Patients over 15kg and need for a top up dose are risk factors for failure and adverse events. This is the largest study in the current literature looking at the use of CH sedation in ophthalmology and confirms its safety and effectiveness.

## Pediatrics: Interesting Cases & Practice Assessment

Sunday 16 June

Paper #107

Surgical Outcome and wait times for Childhood Esotropia in South Western Ontario

Inas H. Makar

**Purpose** Childhood esotropia represents a large proportion of surgical activity of Pediatric Ophthalmologists among all pediatric strabismus surgical cases. The purpose of this study is to review all surgeries performed for esotropia in children over a period of 5 years with regards to esotropia subtypes, motor and sensory outcomes and wait times for those patients.

**Study Design** Retrospective chart review

**Methods** A computer search of the patient database of one pediatric ophthalmologist (I.M.) at the Ivey Eye Institute, University of Western Ontario, was performed to identify the records of all children who received surgery for esotropia 16 years of age or under between August 2007 and October 2012. A total of 289 patients were identified and the following data was captured: Subtype of esotropia, age at surgery, wait time for surgery, type of surgical procedure, number of procedures required for each patient and the motor and functional outcome of all patients.

**Results** A total of 289 children received surgery for esotropia over a period of 5 years representing 76% of all pediatric strabismus surgeries. 261 (90%) children received one procedure and 28 children (10%) required a second procedure to improve alignment. Surgery was performed for 55 (19%) children diagnosed with Infantile esotropia, 75 (26%) children diagnosed with Acquired nonaccommodative esotropia and 81 (28%) children diagnosed with Partially accommodative esotropia representing the major 3 responsible diagnosis, apart from a miscellaneous group of remaining patients (78). 80% of all procedures performed was bilateral medial rectus muscle recession. 61% of all children who needed a second surgical procedure were diagnosed with infantile esotropia. The motor and functional results for all patients will be summarized in the presentation.

**Conclusions** Despite reduction in surgical wait time for surgery, around 25% of all patients achieved measurable stereopsis due to multiple factors including the nature of the disease and the delay in initiating surgical referral.

Retina 1

Sunday 16 June

Paper #108

Effectiveness of the multifocal electroretinogram for early detection of hydroxychloroquine and chloroquine retinal toxicity.

Jennifer Gao, Kevin Leonard, John Hamilton, Stuart Coupland, Chloe Gottlieb

**Purpose** Early detection of hydroxychloroquine (HCQ) and chloroquine (CQ) induced retinal toxicity is crucial for improved health outcomes for patients. It remains challenging, however, to evaluate the diagnostic accuracy of newer testing modalities in the absence of a gold standard test for comparison. The objective of our study is to evaluate the effectiveness of the multifocal electroretinogram (mfERG) in detecting retinopathy in comparison to diagnosis by an expert panel consensus, which acts as a reference standard representative of the clinical setting.

**Study Design** Retrospective review

**Methods** We conducted a retrospective chart review of 162 patients who underwent screening with mfERG for HCQ or CQ induced retinal toxicity from Jan 1, 2007 to May 31, 2011. All mfERG tests were interpreted by an experienced clinical electrophysiologist. We collected clinical and ocular imaging data for the duration of each patient's follow-up with an ophthalmologist from initiation of HCQ or CQ therapy until May 31, 2011. An expert panel independently assessed patients for the development of retinal toxicity using the composite results of serial clinical exams, visual field testing (Humphrey 10-2), and time- or spectral-domain optical coherence tomography (OCT). The accuracy of the mfERG results were compared to the reference test (expert panel) with respect to their temporal relationships.

**Results** The reference test identified a total of 31 of 162 (19.1%) patients who developed some level of retinal toxicity during follow-up. In 29.0% of the cases, the mfERG detected retinopathy prior to the reference test, suggesting enhanced sensitivity. In another 54.8% of cases, the mfERG confirmed the retinal toxicity detected by the reference test. The mfERG had false negative results in 16.1% of cases. Of the 131 patients in whom no retinopathy was detected by the reference test, 70.2% were confirmed by mfERG. In the other 29.8%, the mfERG revealed some level of retinopathy, which indicates either false positive detection or possibly superior sensitivity.

**Conclusions** The mfERG may be more sensitive for the early detection of retinal changes associated with HCQ and CQ as compared to the clinical exam, visual fields, and OCT.

Retina 1

Sunday 16 June

Paper #109

A direct comparison of spectral domain optical coherence tomography (SD-OCT) and multifocal electroretinography (mfERG) findings in hydroxychloroquine retinopathy

Mark E. Seamone, Katherine Milton, Micheline Deschenes, Michael Fielden, Amin Kherani, Geoff Williams

**Purpose** Hydroxychloroquine can cause ocular toxicity in the form of pigmentary retinopathy that is associated with debilitating visual impairment. The early detection of hydroxychloroquine retinopathy is essential to the visual prognosis of affected individuals. Currently, multifocal electroretinogram (mfERG) is considered the gold standard for detecting early-stage hydroxychloroquine-induced retinal pathology. However, accessibility to mfERG is limited and discrepancies in mfERG recordings are often noted upon serial examination of individual patients. Spectral domain optical coherence tomography (SD-OCT) is a newly described method of ocular imaging that allows for high-speed analysis of retinal pathology. In this manuscript, the ability of mfERG and SD-OCT to detect hydroxychloroquine-induced retinal injury was compared.

**Study Design** Prospective cohort study.

**Methods** Patients receiving hydroxychloroquine for a minimum of 5 years (or with clinically apparent disease) were selected on the basis of mfERG findings (N=15). Individual eyes were assigned an mfERG grade (mfERG grade 1-3) reflecting the observed degree of retinal pathology (N=30). Two retinal specialists who are experts in SD-OCT analysis compared SD-OCT abnormalities with mfERG findings for each grade.

**Results** SD-OCT abnormalities were not observed in individuals with grade 1 and 2 mfERG findings. However, SD-OCT was capable of detecting retinal injury in eyes with grade 3 mfERG abnormalities. Commonly observed irregularities included focal and generalized macular thinning, degradation of the IS/OS photoreceptor junction and thinning of the outer nuclear layer (ONL). Interestingly, when eyes with grade 3 mfERG abnormalities were sub-divided into groups of moderate and end-stage hydroxychloroquine toxicity, thinning of the ONL consistently preceded injury to the IS/OS junction. In support of these observations, ONL thickness was decreased in individuals with moderate and end stage toxicity upon quantitative analysis.

**Conclusions** These results suggest that mfERG can detect hydroxychloroquine toxicity prior to SD-OCT. Nonetheless, thinning of the outer nuclear layer upon SD-OCT analysis should raise clinical suspicion of hydroxychloroquine-induced retinal injury. This information is of clinical significance as it suggests that SD-OCT should be used in conjunction with mfERG for the early detection of hydroxychloroquine retinopathy.

Retina 1

Sunday 16 June

Paper #110

Experiences with the Dexamethasone Intravitreal Implant

Ravinder D. Bhui, Micah Luong, Irfan N. Kherani, Micheline C. Deschenes, Michael Fielden, Geoff Williams, Amin Kherani, Wai-Ching Lam

**Purpose** To report the outcomes associated with the use of the intravitreal Dexamethasone implant in various retina diseases.

**Study Design** Retrospective chart review conducted at the University of Toronto and the University of Calgary.

**Methods** All patients receiving their first treatment of intravitreal dexamethasone (0.7mg) for various retinal pathologies were included in the study. Participants received treatment in either Toronto by a single ophthalmologist (17 eyes) or in Calgary by a group of three ophthalmologists (10 eyes). Characteristics including best corrected visual acuity (BCVA), central retinal subfield thickness (CST), and intraocular pressure (IOP) were documented at baseline, one month, three months, and six months after injection. Complications and early retreatment rates were documented also.

**Results** 27 eyes of twenty-one patients were included in the study. 14 eyes received treatment for diabetic macular edema, 6 eyes for branch retinal vein occlusion, 4 eyes for uveitis, and 1 eye for a central retinal vein occlusion. Also, one eye was treated for macular edema post membrane peel surgery and another for macular edema after retinal telangiectasia. Initial BCVA ranged from 20/30 to Hand Motions vision and baseline average CST was 377 micrometers while baseline average IOP was 14.4 mmHg. At 1 month of follow up, average CST was 289 micrometers (decrease of 98 micrometers from baseline) and average IOP was 16.5 mmHg. At 3 months the average CST was 307 micrometers, average IOP was 15.1 mmHg, and five patients had an improvement in visual acuity (mean of one line improvement). 6 months after injection the mean CST was 389 micrometers with a mean IOP of 15.5 mmHg. Three patients had a rise in IOP that required treatment and one patient developed a posterior subcapsular cataract requiring surgery. Four patients required retreatment with intravitreal steroids before 6 months had elapsed (three with intravitreal triamcinolone and one with repeat dexamethasone).

**Conclusions** The intravitreal dexamethasone implant showed continued decreased central subfield retinal thickness measurements at 1 month and 3 months after initial injection. At the 6 month follow up the CST had returned close to pre-injection levels. Most patients tolerated the treatment well and only a few patients experienced the complications of increased IOP or cataract formation.

Retina 1

Sunday 16 June

Paper #111

Resistance of ocular flora to gatifloxacin in patients undergoing intravitreal injections - a case-control study

Stephen J. Dorrepaal, Jeffrey Gale, Sherif El-Defrawy, Sanjay Sharma

**Purpose** To compare resistance to the fourth generation fluoroquinolone gatifloxacin in a population of ophthalmology patients who had received intravitreal injections (IVI) with prophylactic topical gatifloxacin use to resistance in a similar population of patients who had not received IVI.

**Study Design** Nested case-control study.

**Methods** Fifty cases who received prior or concurrent intravitreal injection were enrolled, as were 50 control eyes. Each patient had a conjunctival swab performed on the study eye prior to the instillation of any eye drops. Swabs were sent for microbial identification and testing for gatifloxacin resistance using the ellipsoid test (Etest strips) to determine a Minimum Inhibitory Concentration (MIC) value for each isolate.

**Results** A total of 111 bacterial isolates were obtained from 60 eyes; the remainder of eyes were culture negative. There were no significant differences in bacterial species nor culture positivity rate between case and control eyes (50% in cases vs. 34% in controls,  $p=0.16$ ). The most common organism was coagulase negative staphylococcus (CNS), comprising 64% of all isolates. Resistance to gatifloxacin was observed in 76% of the bacterial isolates and 38% of patients in the case group, as compared to 3% of bacterial isolates and 4% of patients in the control group - a result that was statistically significant ( $p$ -value= 0.0002 and 0.0008, respectively). The mean gatifloxacin MIC was also significantly higher in the case group. No significant difference was found in resistance between the subgroup of cases who had received less <12 injections and those who had received  $\geq 12$  injections.

**Conclusions** The use of topical gatifloxacin for infectious prophylaxis in those who receive intravitreal injection is associated with an increased rate of gatifloxacin resistance among conjunctival isolates.

Retina 1

Sunday 16 June

Paper #112

A Prospective Multicentre Randomized Clinical Trial Comparing Topical Nepafenac Sodium 0.1% versus Intra-operative Intravitreal Triamcinolone Acetate versus Placebo in Vitrectomy for Macular Edema

Lei Di (Lily) Zhao, Wai-Ching Lam, Efreem Mandelcorn, Peter Kertes, Robert Devenyi, Mark Mandelcorn

**Purpose** Vitrectomy surgery for epiretinal membrane often results in post-operative macular edema that manifests as retinal thickening. There are various approaches among retinal surgeons to deal with this complication with no consensus on what is the best treatment. The purpose of this study is to compare the relative efficacy of topical Nepafenac 0.1% versus intravitreal triamcinolone (IVTA) versus observation/placebo in reducing macular edema post-operatively in patients undergoing vitrectomy for epiretinal membrane, as measured by Optical Coherence Tomography (OCT) imaging and Visual Acuity (VA).

**Study Design** This is a prospective, multicenter, randomized clinical trial.

**Methods** 81 patients scheduled to undergo vitrectomy surgery for epiretinal membrane were randomized to receive either IVTA (4mg/0.1cc) at end of surgery, topical Nepafenac sodium 0.1% TID for one month post-operation, or no adjuvant treatment following surgery. OCT imaging, best-corrected VA, and intraocular pressure (IOP) were measured pre-operation, at one and two months post-operation. Primary outcome was change in retinal thickness as measured by OCT. Secondary outcomes were change in VA (converted to logMAR) and IOP. An independent sample Student's t-test was used to detect between-group differences.

**Results** Placebo group showed the most improvement of retinal thickness post-operation as measured by OCT imaging. When compared to pre-operation retinal thickness, mean change at one month post-operation had reduced retinal swelling by  $-63.2\mu\text{m}$  (Nepafenac),  $-92.82\mu\text{m}$  (IVTA) and  $-116.83\mu\text{m}$  (placebo). At two month post-operation, there was further reduction of thickness from baseline by  $-63.89\mu\text{m}$  (Nepafenac),  $-106.11\mu\text{m}$  (IVTA), and  $-136.18\mu\text{m}$  (placebo). The mean change in VA at one month post-operation showed improvement in the Nepafenac ( $+0.135\text{ logMAR}$ ) and placebo groups ( $+0.131\text{ logMAR}$ ) when compared to preoperative VA, while there was decreased VA in the IVTA group ( $-0.015\text{ logMAR}$ ). At two month post-operation, placebo group had the most improvement from baseline with  $+0.207\text{ logMAR}$ , followed by IVTA with  $+0.106\text{ logMAR}$  and then Nepafenac with  $+0.084\text{ logMAR}$ . Patients' IOP showed fluctuations between preoperative and postoperative follow-ups, but overall IOP stayed within normal range of 10-25 mmHg.

Conclusions Although all three groups showed reductions in retinal swelling, the placebo group showed the most improvement at one month post-operation. This is consistent with the VA results, where placebo showed the most improvement out of the three groups post-operation. Overall, the data suggests there was no advantage in the use topical Nepafenac or IVTA for post-PPV ERM surgery.

Retina 1

Sunday 16 June

Paper #113

Aqueous cytokine levels as predictors of treatment response to ranibizumab in diabetic macular edema

Roxane J. Hillier, Elvis Ojaimi, Alan Berger, Filiberto Altomare, Shelley R. Boyd, Farzin Forooghian, David T. Wong, Louis Giavedoni, Radha Kohly, Kenneth Eng, Peter Kertes, Rajeev Muni

**Purpose** To investigate whether anterior chamber cytokine levels, including vascular endothelial growth factor (VEGF), can predict therapeutic response to ranibizumab in diabetic macular edema (DME). This abstract reports the interim findings of this study, due to complete recruitment in December 2012

**Study Design** A REB approved, prospective, non-randomized, observational study of patients with centre involving DME (central macular thickness (CMT)  $\geq 310\mu$  on Cirrus OCT). The primary outcome measure was the relationship between cytokine levels at baseline and OCT treatment response at month three. A 'responder' to treatment was defined as having a reduction in OCT excess CMT of  $\geq 50\%$  compared to baseline (assuming normal OCT CMT to be  $250\mu\text{m}$ )

**Methods** Patients received a monthly injection of ranibizumab to the study eye for three months. Aqueous samples were obtained prior to the first and third injections, and sent for cytokine analysis. Optical coherence tomography (OCT) was performed at baseline, then monthly through to month three. Fluorescein angiography was performed at baseline and month three

**Results**  $n = 20$ . The baseline levels of the following cytokines were significantly elevated in 'responders' versus 'non-responders': Transforming growth factor beta (TGF $\beta$ ) ( $p=0.015$ ), Placental growth factor (PlGF) ( $p=0.024$ ) and Intercellular adhesion molecule-1 (ICAM-1) ( $p=0.026$ ). The following cytokines were higher in 'responders' than 'non-responders', but did not achieve statistical significance: VEGF ( $p=0.135$ ), Vascular cell adhesion molecule (VCAM) ( $p=0.171$ ), Interleukin-6 (IL-6) ( $p=0.275$ ) and Interleukin-10 ( $p=0.180$ )

**Conclusions** This interim data suggests that baseline aqueous cytokine levels may predict favourable treatment response to ranibizumab in patients with DME. In particular, baseline TGF $\beta$ , PlGF and ICAM-1 correlate with reduced OCT thickness at month three. Although baseline VEGF levels were higher in patients who responded favourably to ranibizumab, the data did not achieve statistical significance

Retina 1

Sunday 16 June

Paper #114

Role of Bevacizumab in Persistent and Recurrent Central Serous Chorioretinopathy

Hayat A. Khan, Mohamed K. Tameesh

**Purpose** To describe the anatomical and functional outcome of single intravitreal injection of bevacizumab (avastin) in cases with persistent and recurrent central serous chorioretinopathy (CSC).

**Study Design** A prospective pilot study

**Methods** We included 10 cases with either CSC persistent for at least 3 months or recurrent CSC. Single intravitreal injection of bevacizumab 1.25 mg in 0.05 mL was given to all cases. The main outcome measures were visual acuity change, absorption of subretinal fluid, reduction of active leakage in Fluorescein angiogram (FA). All cases were followed up with serial FA and optical coherent tomography (OCT)

**Results** The mean follow up was  $4.7 \pm 1.4$  months (range 3-6 months). Nine eyes (90%) had visual improvement. Six eyes (60%) gained 2 or more lines in best corrected visual acuity (BCVA) at the last follow up. The mean logMAR BCVA At last follow up was  $0.11 \pm 0.16$  compared to mean logMAR baseline BCVA of  $0.5 \pm 0.25$ . ( $P = 0.003$ ). Six cases showed complete resolution of CSC after one month with improvement of visual acuity while 4 cases showed partial absorption of subretinal fluid. Recurrence of leakage was observed in 2 cases. The mean final central macular thickness (CMT) was  $274.6 \pm 104 \mu\text{m}$ , (range 44-162  $\mu\text{m}$ ) compared to mean baseline CMT of  $483.6 \pm 73 \mu\text{m}$ , (range 63-412  $\mu\text{m}$ ) ( $P = 0.001$ ). No adverse effects were noted.

**Conclusions** Intravitreal bevacizumab seems to have a positive therapeutic effect on cases with persistent and recurrent CSC.

Retina 1

Sunday 16 June

Paper #115

Systemic absorption of intravitreal bevacizumab and ranibizumab in humans treated for diabetic macular edema.

Davin Johnson, Edward B. Moss, Yat Tse, Stephen Pang, Ashley Brissette, Sanjay Sharma

**Purpose** To compare systemic absorption of the anti-VEGF agents bevacizumab and ranibizumab at various time points after intravitreal injection.

**Study Design** Prospective randomized clinical trial.

**Methods** Ten consenting subjects >18 years of age with newly diagnosed diabetic macular edema were recruited and randomized to a series of either bevacizumab (n=5) or ranibizumab (n=5) injections. For the first injection, venous blood samples were taken pre-injection as well as at various time points after injection (1 day, 1 week, 2 weeks, 4 weeks). We measured the levels of both serum VEGF and anti-VEGF levels in each of the samples.

**Results** We have thus far successfully developed and pilot tested an assay to measure levels of anti-VEGF agents in the bloodstream in humans. Final analysis of our study samples will occur when all samples are collected (in approximately January 2013) to allow sufficient time for data analysis prior to the COS conference.

**Conclusions** To our knowledge this is the first ever study to measure levels of anti-VEGF agents in the bloodstream in humans. Given concerns over systemic adverse effects the results of our study will be highly clinically relevant.

## Cornea- Controversies in Corneal Surgery

Sunday 16 June

Paper #116

Corneal collagen crosslinking with riboflavin (CXL) for the treatment of infectious keratitis

Kashif Baig, Salina Teja, George Mintsoulis, W. Bruce Jackson

**Purpose** Corneal crosslinking has become a treatment option for ulcers refractory to medical treatment, and has been shown to prevent the need for emergency keratoplasty. Our purpose is to describe 14 cases of infectious keratitis of bacterial and non-bacterial etiology managed by crosslinking, and highlight features of certain cases that failed or succeeded the treatment.

**Study Design** Retrospective case series.

**Methods** The charts of 14 patients with infectious keratitis were reviewed retrospectively. All patients had culture-positive microbiology, failed to respond to antimicrobial therapy, and had CXL within 3 months of presentation entailing 40 minutes of hypoosmolar riboflavin and 40 minutes of UVA light. Adjunct antimicrobial therapy post-CXL was used in all cases. Pre- and post-operative events were documented.

**Results** Of the 14 patients, 3 were contact lens wearers and 8 had preexisting corneal disease (4 of which were due to recurrent corneal ulcer). Infectious organisms included 8 bacteria, 4 fungus, 1 virus, and 1 protozoa. All had epithelial defects, 7 had a hypopyon. 13 patients achieved resolution of symptoms within 1 week, while the remaining patient took 6 weeks. 12 patients showed improvement or stability in visual acuity. The procedure was successful in 10 patients, showing re-epithelialization and resolution of infiltrate within 4 months. The remaining 4 patients failed the procedure (fusarium, candida, acanthamoeba, alternaria), requiring emergency transplant. Recurrence of infection occurred in one patient.

**Conclusions** CXL in infectious keratitis has been reported in case series and most recently a prospective study, documenting its success in treating bacterial ulcers, and ability to prevent emergency keratoplasty. Our study uniquely contributes a detailed description of 14 cases, including 6 fungal, viral and protozoan ulcers, and provides the context of our patients that succeeded versus failed treatment.

## Cornea- Controversies in Corneal Surgery

Sunday 16 June

Paper #117

Pre-stripped DMEK: Complications and visual outcomes in a series of 43 consecutive eyes.

Julia C. Talajic, Mark A. Terry, Michael D. Straiko, David Davis-Boozer

**Purpose** To report outcomes of Descemet's membrane endothelial keratoplasty (DMEK) using eyebank technician-prepared "pre-stripped tissue".

**Study Design** Retrospective review of prospectively collected data in a consecutive interventional case series.

**Methods** 43 eyes underwent DMEK using the Yoeruek tap technique 1-2 days following donor pre-stripping by EBAA-certified technicians. The following outcomes are reported: the rate of donor tissue tears during pre-stripping, rates of graft dehiscence and rebubbling, the rate of primary graft failure, and mean postoperative best-corrected visual acuity (BSCVA).

**Results** All tissues were successfully pre-stripped and there was no tissue wastage. Graft dehiscence occurred in 17 (40%) cases, all of which were rebubbled. 2 eyes required 2 or more rebubbling procedures. 16 rebubbled grafts were successful while 1 failed. Primary graft failure occurred in 3 eyes overall, 1 of which had undergone unsuccessful rebubbling. The mean BSCVA improved from 0.331 (Snellen equivalent 20/43) preoperatively to 0.065 (Snellen: 20/23) at 1-3 months postoperatively. Initial published DMEK series using surgeon-prepared tissue illustrate graft failure rates of 8% to 20% and rebubbling rates of 50% to 92%.

**Conclusions** Pre-stripping greatly facilitates DMEK surgery as it transfers the liability of potentially wasting tissue from the surgeon to the eyebank, avoids the risk of case cancellation, and makes better use of operating room time. The complication rate using pre-stripped tissue is not greater than that reported with surgeon-stripped tissue. Visual acuity after DMEK with pre-stripped tissue is excellent.

## Cornea- Controversies in Corneal Surgery

Sunday 16 June

Paper #118

Use of a dual-purpose donor corneal tissue for DMEK and DALK

Larena Menant-Tay, Salina Teja, Kashif Baig

**Purpose** Dual-purpose corneal tissue (one donor for two transplant procedures) may one day serve as an approach to save corneal tissue and reduce transplant costs. Our purpose is to assess the surgical and post-operative outcomes of using a dual-purpose donor cornea for two lamellar transplants: Deep Anterior Lamellar Keratoplasty (DALK) and Descemet's Membrane Endothelial Keratoplasty (DMEK). Difficulties with tissue preparation and 6-month outcomes were evaluated, and compared to the outcomes reported in the literature for single-purpose donor cornea transplant procedures (standard of care).

**Study Design** Retrospective case series.

**Methods** Six patients who underwent DALK or DMEK with dual-purpose donor corneal tissue were reviewed. A trephine-peel technique was used to harvest the 3 DMEK grafts, with the remaining tissue used as DALK grafts. In this method, corneoscleral rims were superficially trephined from endothelium to Descemet's Membrane (DM). DM was then loosened from the stroma and peeled from the trephined edge to the central cornea. This graft was used for a DMEK procedure, while the epithelium-stroma was used for a DALK procedure on the same day. Outcomes including tissue preparation challenges, intraoperative complications, and postoperative graft adherence and visual recovery were assessed.

**Results** There were no difficulties preparing the 3 dual-purpose tissues, and we were able to complete 6 lamellar transplants. At the 1-month follow-up, mean corrected distance visual acuity was 20/180 in the 3 descmetic DALK patients and 20/70 in the 3 DMEK patients. Post-operative complications after DALK included retained viscoelastic agent at the interface in one patient requiring partial lifting of the graft, thorough irrigation, and re-suturing of the graft. Another DALK patient had endothelial detachment (double anterior chamber sign) that was adequately managed with re-bubbling. After DMEK, a peripheral partial graft detachment occurred in 1 patient and was managed with re-bubbling. All corneas demonstrated clarity on slit-lamp examination. 6-month follow up will be available by March 2013.

**Conclusions** Lamellar keratoplasty techniques are being increasingly utilized due to faster visual rehabilitation, reduced graft rejection, and a lower incidence of postoperative complications. We explored the pre-, intra-, and post-operative issues of using one donor tissue for 2 lamellar procedures. Our results show that the dual-purpose corneal tissue is feasible for harvesting and saving donor tissues. Additionally, the resulting postoperative corneal clarity and graft adherence

observed in our patients is similar to that obtained using single-purpose donor corneal tissue. Dual-purpose corneal tissues for DALK and DMEK may be used to improve the efficiency of corneal transplantation.

## Cornea- Controversies in Corneal Surgery

Sunday 16 June

### Paper #119

Descemet's Stripping Automated Endothelial Keratoplasty (DSAEK) versus Ultra-Thin DSAEK (UT-DSAEK) versus Descemet's Membrane Endothelial Keratoplasty (DMEK): comparison of surgical and visual outcomes

Peng Yan, Salina Teja, Kashif Baig

**Purpose** Several variations of endothelial keratoplasty have evolved over the past 10 years, resulting in a rapidly changing approach to patients with corneal endothelial disease. Our purpose is to compare the surgical and visual outcomes between DSAEK, UT-DSAEK and DMEK as treatments for Fuch's Endothelial Dystrophy (FED) and Pseudophakic Bullous Keratopathy (PBK).

**Study Design** Retrospective comparative case series.

**Methods** The first ten consecutive DSAEK, UT-DSAEK, and DMEK patients with either FED or PBK were reviewed retrospectively. In DSAEK, a 350um head was used for all single-pass dissections. In UT-DSAEK, donor corneas were prepared by a two-pass microkeratome dissection. In DMEK, a trephine-peel technique was used to prepare the graft. Data was collected from baseline up to 6-months follow-up, and outcomes including intraoperative and postoperative complications, visual rehabilitation, endothelial cell density (specular microscopy) and follow-up graft thickness (anterior segment OCT) were compared.

**Results** The average age was 76, 69, and 67.5 years for DSAEK, UT-DSAEK, and DMEK respectively. All patients had a history of cataract extraction and intraocular lens placement, with an equal number of FED and PBK presentations. Mean donor endothelial cell count was 2597 for DSAEK, 2590 for UT-DSAEK group and 2709 for DMEK. No donor tissues were lost during tissue preparation. The DSAEK group had a mean preoperative best-corrected visual acuity (BCVA) of 20/200 with mean intraocular pressure (IOP) of 17mmHg. The UT-DSAEK group had a mean preoperative BCVA of 20/80 with mean IOP of 13mmHg. The DMEK group had a mean pre-operative BCVA of 20/120 with mean preoperative IOP of 14mmHg. One patient in the DSAEK group had an inferior graft displacement that did not require further management. One patient in the DMEK group had a large persistent peripheral graft detachment despite 3 re-bubbling attempts and required a second DMEK procedure. Six-month outcomes of visual rehabilitation, endothelial cell loss, graft thickness and graft rejection for all patients will be available by March 2013.

**Conclusions** Endothelial Keratoplasty is constantly evolving, with DSAEK currently being the standard of care. Available literature has shown the benefits of UT-DSAEK and DMEK,

including lower rates of graft rejection, faster and greater visual recovery and comparable endothelial cell loss. The difficulties with tissue preparation however, have resulted in a slower transition to these two procedures. This comparison of outcomes between our first 10 consecutive patients having each procedure will shed light on the relative learning curve and encourage corneal surgeons to consider the benefits of providing these advanced treatments to their patients.

## Cornea- Controversies in Corneal Surgery

Sunday 16 June

Paper #120

Descemet's Membrane Endothelial Keratoplasty (DMEK): challenges and lessons learned after the first 10 cases

Abdulmajed O. Aljaethen, Salina Teja, Kashif Baig

Purpose Descemet's Membrane Endothelial Keratoplasty (DMEK) is the newest technique in endothelial keratoplasty, with favorable outcomes due to the elimination of stroma in the transplanted graft. While this technique provides superior visual outcomes and lower rates of graft rejection, it is significantly more challenging in terms of technical difficulty. Due to tissue fragility, both harvesting donor tissue as well as implanting the graft into the patient's eye have a steep learning curve. Corneal surgeons have been hesitant to begin DMEK surgery because of this. Our purpose is to report on our experiences with our initial 10 cases of DMEK, including lessons learned and technique modifications.

Study Design Descriptive study

Methods 10 initial and consecutive DMEK cases were included. All patients had a preoperative diagnosis of Fuch's endothelial dystrophy or pseudophakic bullous keratopathy. Preoperative, intraoperative, and postoperative management experiences are discussed in detail. We further report on how we have modified our technique based on these lessons learned.

Results Preoperative challenges include choosing the right patient for the DMEK procedure. This entails gauging the extent of host corneal edema that will allow for good visibility to manipulate and orient the DMEK graft, assessing iridectomies, iris defects, and glaucoma valve implants to minimize the chance of tissue loss, doing a preoperative laser peripheral iridotomy, and selecting donor tissue of the appropriate age. Intraoperative challenges include choosing the appropriate donor preparation technique, using various injecting devices to insert tissue into the eye, learning the amount of Descemet's stripping needed to achieve good graft adherence, managing air in vitrectomized and filtered eyes, and facilitating the unrolling of the DMEK scroll. Postoperative challenges and lessons learned include rebubbling detached tissue, using anterior segment OCT to guide decision-making, and managing graft failure.

Conclusions The available literature shows that DMEK is a superior surgical alternative to DSAEK with faster visual recovery, more patients with 20/20 or 20/25 vision, comparable endothelial cell loss, and lower rates of graft rejection. Corneal surgeons are hesitant to provide DMEK surgery to their patients due to difficult tissue preparation and intraoperative handling. We hope that this report of our early experience will facilitate the learning curve of adopting this latest technique in endothelial keratoplasty.

## Cornea- Controversies in Corneal Surgery

Sunday 16 June

### Paper #121

A comparative study of corneal collagen crosslinking for keratoconus in thin versus thick corneas

Salina Teja, W. Bruce Jackson, Pierre-Jerome Bergeron, George Mintsoulis, Kashif Baig

**Purpose** Initial studies of CXL in keratoconus were performed with corneas  $>400\mu\text{m}$  after epithelial removal to avoid harm to the endothelium. Recently, CXL protocol has been modified to treat thinner corneas, however the outcomes in these patients are not well established. Our purpose is to compare the 12-month anatomic and visual outcomes of CXL keratoconus corneas between thin ( $<400\mu\text{m}$  after epithelium removal) and thick ( $>400\mu\text{m}$  after epithelium removal) groups.

#### Study Design Comparative case series

**Methods** All patients received CXL after epithelial removal, with 30 minutes of riboflavin (thick received isoosmolar, thin received hypoosmolar to swell the cornea), and 30 minutes of Ultra Violet A (UVA) radiation. 50 eyes in the thin group and 62 eyes in the thick group matched inclusion criteria. These 112 charts were reviewed retrospectively. Baseline and post-operative (1-, 3-, 6- and 12-month) measures of keratometry, uncorrected and corrected distance visual acuity (UDVA and CDVA), corneal thickness, and refractive error were recorded. A repeated measure regression was performed for each variable separately and stratified by group. The outcomes between the groups were compared in order to assess the procedure's relative effect on ectatic changes.

**Results** Preoperatively, the thin group had a mean maximum keratometry (Kmax) of 56D, mean thinnest corneal thickness (TCT) 403 $\mu\text{m}$  (after epithelium removal mean 365 $\mu\text{m}$ ), mean cylinder 4.4D, mean UDVA  $1.53 \pm 0.70$  logMAR (20/630 snellen equivalent) and mean CDVA  $0.41 \pm 0.32$  logMAR (20/50 snellen equivalent). The thick group showed less severe keratoconus at baseline with a mean Kmax of 49D, mean TCT of 469 $\mu\text{m}$  (after epithelium removal mean 442 $\mu\text{m}$ ), cylinder 3.3 D, mean UDVA  $0.95 \pm 0.81$  logMAR (20/180 snellen equivalent) and mean CDVA of  $0.13 \pm 0.18$  logMAR (20/30 snellen equivalent). At 6-month follow-up, significant improvement in UDVA to 1.08 logMAR (approximately 20/250 snellen equivalent) ( $p=0.01$ ) was seen in the thin group. In the thick group, significant reduction in mean Kmax to 47.5 D ( $p<0.001$ ) and astigmatism to 2.3D ( $p=0.01$ ) was seen. 12-month results will be available by March 2013.

**Conclusions** Crosslinking has been shown to halt progression and cause regression of keratoconus in corneas that have a thickness  $>400\mu\text{m}$  after epithelium removal. The procedure

has been modified to treat patients with below-threshold thick corneas by using hypoosmolar riboflavin to swell the cornea, thereby reducing the potential for endothelial damage and stromal scars. There are only 2 small retrospective case series reporting the outcomes of the modified protocol, however currently no studies comparing them to the standard protocol. Our study shows that at 6 months, there is no significant improvement of ectasia in corneas that are <400um however CXL does halt progression.

Pediatrics: ROP, IOLs & PFV, Terson syndrome, botulinum toxin

Sunday 16 June

Paper #122

Botulinum Toxin-induced ptosis in the management of corneal ulceration in anaesthetic corneas

Christopher Lyons, Elham Saud, Jane C. Gardiner, Ashley S. Ko

**Purpose** To report the use of reversible ptosis to induce corneal healing in children with corneal anaesthesia

**Study Design** Retrospective study

**Methods** All children with corneal anaesthesia attending the eye clinic at Children's Hospital from Jan 1st 2003 to Dec 31 2012 were recruited to the study. The etiology of the corneal anaesthesia, mode of presentation, management and outcome were reviewed.

**Results** Six patients were identified. Etiologies included Mobius syndrome, familial corneal anaesthesia, congenital corneal anaesthesia with deafness, brainstem tumour with trigeminal anaesthesia, congenitally hypoplastic trigeminal nerve. One patient had extensive brainstem anomalies. In three patients with severe ulceration of neurotrophic cornea botulinum toxin-induced ptosis resulted in rapid resolution of the ulcer and infection.

**Conclusions** We review the causes and presentation of children with anaesthetic cornea. Botulinum toxin-induced ptosis is an important option which can result in rapid resolution and corneal healing. The two patients treated in the amblyogenic period had good visual outcomes.

Pediatrics: ROP, IOLs & PFV, Terson syndrome, botulinum toxin

Sunday 16 June

Paper #123

Outcomes of persistent fetal vasculature cataracts with primary intraocular lens implantation

Lisa Lagrou, William F. Astle

**Purpose** To assess visual acuity outcomes and incidence of glaucoma in persistent fetal vasculature cataracts with intraocular lens implants.

**Study Design** Interventional, single surgeon, case series

**Methods** Patient records of children (ages 0-18 years) who underwent cataract extraction and intraocular lens implantation at Alberta Children's Hospital, Calgary, Alberta, Canada between the years of June 1995 and October 2012 were retrospectively reviewed. Of the 173 patient charts that were screened, 21 patients had a persistent fetal vasculature cataract extraction with intraocular lens implantation. All patients underwent a primary lensectomy, anterior vitrectomy, and posterior capsulotomy. All but 1 had an intraocular lens implanted at the time of the cataract removal. One patient had an intraocular lens implanted 45 months following the primary surgery and 1 patient had a secondary intraocular lens implanted. The patients were followed for an average of 53 months (range 3-132).

**Results** All of the persistent fetal vasculature cataracts were unilateral except one patient who had bilateral disease. Both male patients and the left eye were affected in 52% (11 of 21) of the cases. Microphthalmia occurred in 67% of these patients (14 of 21). Vision at presentation was central, steady and unmaintained in 57% (12 of 21) of cases. Average age at diagnosis was 14.1 months of age (range 0.1-72), with surgery completed on average 7.3 months later (range 0.5-48). One patient developed hyphema during cataract removal, and three developed vitreous hemorrhage that cleared without further sequelae within 2 weeks. The average visual acuity improved to logmar 0.976 (snellen equivalent: 20/190). Fixation was demonstrated in the persistent fetal vasculature eye in 71% of patients, with all but 1 patient achieving improved visual acuity compared to initial presentation. Secondary membranes, requiring surgical removal, occurred in 43% of patients, two of which needed more than one procedure. Strabismus occurred in 71% of cases, 52% of which were surgically repaired through a recess and resect procedure of the involved eye. No glaucoma was detected in any of the cases. 29% (6 of 21) of patients required additional surgical procedures, in addition to membranectomy and strabismus.

**Conclusions** In this study, we demonstrate consistent visual acuity improvement in persistent fetal vasculature with primary intraocular lens implantation, as compared to more standard surgery in this young age group. None of our patients have developed detectable glaucoma.

Pediatrics: ROP, IOLs & PFV, Terson syndrome, botulinum toxin

Sunday 16 June

Paper #124

Terson syndrome in children

Jesia Hasan, Ahmed Basheikh, Fabricio Goncalves, Ayesha Khan

**Purpose** Terson syndrome (TS), defined as intraocular hemorrhage in the setting of intracranial bleeding, is rare in the pediatric population and its description in the literature is limited. We aim to describe the clinical and radiologic characteristics of TS in children.

**Study Design** Retrospective case series.

**Methods** We report on 4 cases of TS seen at our institution between September 2010 and October 2011. Patient ages ranged from 2 days to 13 years. The presence of intracranial and subarachnoid hemorrhage was documented by noncontrast CT head in three patients. Brain ultrasonography confirmed the presence of intraventricular blood in one patient. Inflicted childhood neurotrauma was ruled out in each case. All patients underwent a full ophthalmologic exam. Retinal findings were documented by RetCam and fundus photography.

**Results** The etiology of intracranial bleeding included vertebral artery dissection, motor vehicle accident, subarachnoid cyst rupture and intraventricular hemorrhage of prematurity. Peripapillary retinal hemorrhages (RH) were found in all 4 patients. As well, extensive peripheral RH (1 patient), vitreous hemorrhage (1 patient) and sub-internal limiting membrane hemorrhages (2 patients) were observed. Optic nerve sheath hemorrhage was seen in 3 patients on noncontrast CT head.

**Conclusions** This case series demonstrates that TS in children occurs with both traumatic and spontaneous intracranial hemorrhage and presents with varying patterns of posterior segment bleeding. Furthermore, this study shows that optic nerve sheath hemorrhage may be observed on noncontrast CT head in patients with Terson syndrome.

Pediatrics: ROP, IOLs & PFV, Terson syndrome, botulinum toxin

Sunday 16 June

Paper #125

Treatment Outcomes of Combined Laser with Intravitreal Bevacizumab versus Laser Treatment Alone in cases of Aggressive Posterior Retinopathy of Prematurity (APROP)

Hayat A. Khan, Mohamed K. Tameesh

**Purpose** To report the efficacy and safety of combined laser with intravitreal bevacizumab versus laser treatment alone in cases of APROP

**Study Design** A prospective interventional case series of 13 premature babies (26 eyes), all of whom were diagnosed with APROP was conducted.

**Methods** Six babies (12 eyes) received combined laser treatment with intravitreal injection of 0.625mg of bevacizumab in 0.025ML (group A) while the remaining seven babies (14 eyes) received only laser treatment (group B). Patients were examined at 1, 2, 4 weeks and then every 4 weeks for at least 6 months. Primary outcome measures: regression of the active ROP. The secondary outcome measures include: recurrence of the disease, development of complications such as vitreous hemorrhage and /or fibrotic complications including tractional detachment.

**Results** Twenty six eyes of 13 babies (8 males and 5 females) were included in the study. Mean gestational age and birth weight were: 27.07 weeks (range 24-29 weeks), 932.4 grams (range 690-1200 grams) respectively. Mean gestational age at the time of treatment was 36.6 weeks. All twelve eyes (100%) in group A showed regression of the active disease (disappearance of extraretinal neovascularization and plus disease) within two weeks, in comparison only 11 eyes (78.5 %) out of the 14 eyes in group B showed complete regression. Two eyes (16.6%) in group A and 4 eyes (28.6%) in group B developed vitreous hemorrhage. Two eyes (16.6%) in group A developed cataract. In group A, five eyes (41.6%) developed fibrous vitreoretinal bands along the major vascular arcade 2-4 months after treatment, which progressed to tractional detachment in 2 eyes (16.6%).

**Conclusions** Combined laser with intravitreal bevacizumab injection is more effective than laser treatment alone in inducing a rapid and complete regression of the active disease in cases of APROP, however the rate of complications such as complicated cataract, and fibrotic complications including tractional retinal detachment are relatively high.

Pediatrics: ROP, IOLs & PFV, Terson syndrome, botulinum toxin

Sunday 16 June

Paper #126

Seminal Canadian Recommendations for Evidence Based Examination of Neonates for Retinopathy Of Prematurity (SCREEN-ROP): Provisional New Guidelines

Kouros Sabri, Kaitlyn Whelan, Virginia Viscardi, Niraj Patel, Wendy Seidlitz, Forough Farrokhyar, Sandesh Shivananda, Anna Ells, Shoo Lee

**Purpose** Currently there are no universally accepted ROP screening inclusion criteria in Canada. Among the 23 Canadian NICU's recently surveyed, there are 7 different screening guidelines in use. The purpose of this study is to set evidence-based national guidelines for ROP screening inclusion criteria and frequency of screening.

**Study Design** This is an observational, prospective, multi-centered national study.

**Methods** Through the Canadian Neonatal Network and contacting all ophthalmologists treating ROP in Canada, 46 fields of data are being collected on all babies born in 2012 and 2013 who are screened for ROP in all 30 Level 3 NICU's in Canada and all babies treated for ROP in Canada. Following data analysis, new ROP screening guidelines will be developed both for inclusion criteria and frequency of screening. These new recommendations formulated based on 2012 data will be validated by applying them to the 2013 data. Once shown that the new screening guidelines are 100% sensitive in detecting severe ROP, they will be presented to the ophthalmology community for national acceptance at the 2014 COS meeting.

**Results** The 2012 data is currently being received on a continuous basis from all 30 Level 3 NICUs in Canada and from all treating ophthalmologists. So far there are 869 babies born in 2012 who have been screened for ROP, of which 53 have been treated for ROP. Of the 53 children receiving treatment for ROP, 7 children received a second treatment and 3 children received a third treatment. Among the treated babies, the birth weight ranges from 470g to 970g (720g +/- 250g) and the gestational age at birth ranges from 23 weeks to 30 weeks (26.5 weeks +/- 3.5weeks). The gestational age at the time of first ROP treatment ranges from 31 weeks to 46.4 weeks (38.7 weeks +/- 7.7 weeks). There have been 112 (55 left, 57 right) eyes treated so far of which 96 eyes have been treated just once, 11 have been treated twice and 5 have been treated three times. Of the 96 eyes treated once, 52 received laser and 44 received anti-VEGF injections.

**Conclusions** This is the first prospective national study aimed at collecting a wide range of data on babies screened and treated for ROP. The aim of this study is to develop evidence-based screening guidelines which will be accepted nationally to ensure the capture of all severe cases of ROP while reducing the overall burden of screening.

Retina 2

Sunday 16 June

Paper #127

Seminal Canadian Recommendations for Evidence Based Examination of Neonates for Retinopathy Of Prematurity (SCREEN-ROP): Provisional New Guidelines

Kouros Sabri, Kaitlyn Whelan, Virginia Viscardi, Niraj Patel, Wendy Seidlitz, Forough Farrokhyar, Sandesh Shivananda, Anna Ells, Shoo Lee

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Retina 2

Sunday 16 June

Paper #128

Chromatic Pupillometry in Patients with Leber Congenital Amaurosis LCA: Feasibility Testing, Residual Retinal Cell Function, and Paradoxical Pupil Response.

Radwan Ajlan, Leah Wood, Robert Koenekoop

**Purpose** This is a feasibility study in blind children with LCA due to various genotypes. We are investigating if rod and cone photoreceptor or ganglion cell function remains. We are also interested in investigating the paradoxical pupil response and we want to test which cell system is involved in this response.

**Study Design** Prospective cohort study.

**Methods** 30 LCA patients with varied genotypes illustrating various disease mechanisms were included in the study. The spectral bands for this study are  $640\pm 10$  nm (red light to stimulate cones),  $467\pm 17$  nm (blue light to stimulate rods), and sustained 467 nm (to stimulate ganglion cells). We also used white light under mesopic conditions of adaptation to get an idea of overall pupil response. A stimulus range of 2 log-units using 3 stimulus intensities (1, 10, and 100 cd/m<sup>2</sup>) were used.

The light stimulus paradigm consists of, the first light stimulus at 1 cd/m<sup>2</sup> for 13 seconds, followed by a second light stimulus at 10 cd/m<sup>2</sup> for 13 seconds, followed by a third light stimulus at 100 cd/m<sup>2</sup> for 13 seconds, followed by darkness (light termination) using red-light stimulus first. After a minimum interval of 60 seconds without light stimulus, the paradigm was repeated using the blue-light stimulus, and then the white light after another 60 seconds without light stimulus. Statistical analysis of the data was performed.

**Results** We identified mutations in NMNAT1, CRB1, GUCY2D, AIPL1, and many other LCA genes. Interestingly, most of the blind LCA patients showed significant pupillary response, despite a non-recordable electroretinogram ERG. The more severe the disease, the less pupillary response, however stimulating the intrinsically photosensitive melanopsin ganglion cells ipRGCs in these patients using blue light in highest intensity was found to generate the most prominent response when present (> 75% pupillary constriction sometimes, p-value <0.001).

**Conclusions** Pupillometry testing is becoming a promising method for testing different retinal cell types objectively in a noninvasive way using preferential light stimulation while bypassing any cortical processing. Pupillometry is a promising tool to assess emerging drug and gene therapies for blindness. Our data also describes the retinal cells and layer mostly affected in the different genotypes included in the study, as well as providing evidence of residual viable cells thought previously to be completely lost.

## Retina 2

Sunday 16 June

### Paper #129

Demonstration of anatomical development of the human macula within the first five years of life using Optical Coherence Tomography (OCT)

Talal Alabduljalil, Arun Reginald, Carol Westall, Wai-Ching Lam

**Purpose** To demonstrate the anatomical development of the human macula using the handheld spectral domain (SD) OCT during the first 5 years of age

**Study Design** Cross-sectional, prospective, observational case series

**Methods** Thirty-five normal eyes of 35 full term children less than 5 years of age were enrolled. An institutional review ethics board approval was obtained at the Hospital for Sick Children. Subjects were recruited from the operating room. The handheld SD OCT was used to image the macula of each eye. The images were analyzed using the caliber function from the machine. Retinal layers thickness was measured at the fovea and 1mm nasal and temporal to the fovea (parafovea). The measured retinal layers were: total retinal thickness, inner retinal layers thickness and photoreceptor layer thickness. Subjects were divided into: Group 1 is 12 months old and less, Group 2 is 12 months to 24 months and Group 3 is 24 to 60 months. A multivariate regression analysis was used to compare the three groups according to the retinal layers thickness at the foveal and parafoveal location.

**Results** Consistent with in vitro histopathological studies, the handheld SD OCT demonstrated continuing macular development in the first five years of age in the foveal and parafoveal region. The average total foveal thickness was 134.6  $\mu\text{m}$  for group 1, 154.6  $\mu\text{m}$  for group 2, and 170.9  $\mu\text{m}$  for group 3. The difference in the total foveal thickness was statistically significant between group 1 and 2  $p=0.019$ , and between group 2 and 3  $p=0.006$ . Mean while, the average photoreceptor layers thickness at the fovea was 111.4  $\mu\text{m}$  for group 1, 135.8  $\mu\text{m}$  for group 2, and 152.6  $\mu\text{m}$  for group 3. The difference in the foveal photoreceptor layer thickness was statistically significant between group 1 and 2  $p=0.001$ , and between group 2 and 3  $p=0.002$ . This is consistent with centripetal cone packing. The average parafoveal total retinal thickness was 270  $\mu\text{m}$  for group 1, 279  $\mu\text{m}$  for group 2, and 295  $\mu\text{m}$  for group 3. The difference in the total parafoveal thickness was statistically significant between group 2 and 3  $p=0.021$ . The average photoreceptor layers thickness at the parafovea was 97.6  $\mu\text{m}$  for group 1, 116.3  $\mu\text{m}$  for group 2, and 122.8  $\mu\text{m}$  for group 3. The difference in the parafoveal photoreceptor layer thickness was statistically significant between group 1 and 2  $p=0.029$ .

**Conclusions** The Bioptigen SD OCT is a useful imaging tool to detect foveal development in children below five years of age. This study is the first to demonstrate in vivo the normal foveal and parafoveal development in full term normal children below 5 years of age.

Retina 2

Sunday 16 June

Paper #130

Outcomes and complications of Densiron 68 intraocular tamponade for retinal detachment repairs: a retrospective chart review.

James Macdonald, Geoff Williams, Feisal Adatia, Kevin Warrian, Karim Hammamji, Micheline C. Deschenes, Andrew Kirker, Amin Kherani

**Purpose** To report and evaluate the outcomes and complications of Densiron 68 intraocular tamponade for retinal detachment repair.

**Study Design** We present a retrospective chart review of sixty-nine eyes from sixty-eight patients operated on by three different surgeons.

**Methods** All patients underwent vitrectomy and tamponade with Densiron 68 high-density silicone oil. Additional surgical procedures and therapies were performed at the Surgeons' discretion. Anatomical reattachment of the retina, visual acuity, intraocular pressure and any other ocular findings are recorded and analyzed. The study population is presented in two groups: one with Densiron 68 removed as intended and a second group with the Densiron 68 still in situ.

**Results** Fifty-five eyes of 54 patients had Densiron 68 removed. Anatomical success was noted in 53 (96.4%) of the eyes with 13 (24.5%) requiring further surgical treatment. Visual acuity improved from mean logMAR of +1.73 (SD=0.94) to a mean logMAR of +1.25 (SD=0.92). The most common complications observed include cataract formation (85.7%), intraocular inflammation with aqueous cells and flare (65.5%), emulsification or dispersion of the oil into the anterior chamber (43.6%), ocular hypertension (41.8%), transient hypotony (38.1%), recurrent retinal detachment (23.6%), posterior synechia (21.8%), posterior capsule opacification (20.6%), corneal edema (20%) and new fibrous epiretinal membrane formation (18.1%). Fourteen eyes of 14 patients still had Densiron 68 in situ at the time of review. The most common complications include new epiretinal membrane formation (50%), emulsion and dispersion of the oil into the anterior chamber (28.6%), intraocular inflammation with aqueous cells and flare (28.6%), ocular hypertension (28.6%), vitreous hemorrhage (21.4%) and corneal edema (21.4%).

**Conclusions** Densiron 68 provides the Vitreoretinal Surgeon with a high-density intraocular tamponade effective in the treatment of complex retinal detachments. Surgeons considering its use should be aware of the complications reported in our study, most notably emulsion and dispersion of the oil, resulting in challenges in its removal.

Retina 2

Sunday 16 June

Paper #131

Using patient positioning to promote resorption of subretinal fluid in rhegmatogenous retinal detachment prior to pneumatic retinopexy

Stephen J. Dorrepaal, Jeffrey Gale

**Purpose** Pneumatic retinopexy is a surgical procedure commonly used in the repair of rhegmatogenous retinal detachment. Based on clinical experience, the authors undertook this study to determine if the volume of subretinal fluid in acute rhegmatogenous retinal detachment may be reduced through patient positioning so that the tear is at the lowest point of the globe for a period of one hour, prior to transconjunctival cryotherapy and pneumatic retinopexy.

**Study Design** Prospective, masked, nonrandomized cohort study

**Methods** The change in subretinal fluid volume in patients with rhegmatogenous retinal detachment was measured both before and after a one-hour period of specific head positioning using serial sagittal B-scan ultrasonography.

**Results** Ten patients with acute unilateral rhegmatogenous retinal detachment were enrolled. All patients experienced a reduction in subretinal fluid volume, from  $0.89 \pm 0.63$  mL to  $0.45 \pm 0.43$  mL, a reduction of 55.4%. At six months, all patients maintained or improved visual acuity as compared to their baseline, and all patients achieved complete retinal reattachment.

**Conclusions** In patients with acute rhegmatogenous retinal detachment that fall within the classic indications for pneumatic retinopexy, significant reduction of subretinal fluid volume may be obtained through a one-hour period of patient positioning in a retinal break-dependent manner.

Retina 2

Sunday 16 June

Paper #132

Epiretinal Membrane Peeling with Brilliant Blue Chromovitrectomy

Kevin J. Warrian, Sarit Khimdas, Alysia Zhou, John R. Gonder

**Purpose** To evaluate the improvement in visual acuity provided by epiretinal membrane removal using brilliant blue chromovitrectomy in a Canadian tertiary care center.

**Study Design** Retrospective

**Methods** A medical chart review was conducted to locate all cases of idiopathic epiretinal membrane treated with vitrectomy, epiretinal membrane peeling and internal limiting membrane peeling using brilliant blue staining. Preoperative and post operative visual acuity in the form of logMAR units, obtained by refraction served as the primary surgical outcome. Descriptive statistics, correlation and regression coefficients were utilized to determine improvement in visual acuity resulting from epiretinal membrane surgery using brilliant blue.

**Results** : Fifty six eyes were included in the analysis. The mean follow up period was 12.6 months (95% CI 14.9 - 10.9). The average preoperative visual acuity was -0.48 (95% CI -0.62 - -0.37), with a range of -3.0 - 0.0. Postoperative visual acuity had a mean value of -0.24 (95% CI -0.29 - -0.18) and a range of -0.8 - 0.0. The average visual acuity improvement was 0.25 (95% CI 0.15 - 0.36) with a range of 2.41 - -0.30. Preoperative visual acuity was moderately correlated with final visual acuity ( $r = 0.500$ , 95% CI 0.273 - 0.679). Preoperative visual acuity was highly correlated with improvement in visual acuity ( $r = -0.898$ , 95% CI -0.529 - -0.959). Multiple linear regression analysis demonstrated a highly predictive relationship between preoperative visual acuity and absolute visual acuity improvement, after controlling for preoperative phakic status and months of post surgical follow up ( $r^2 = 0.820$ ,  $\beta$  weight -0.781, 95% CI 0.865 - 0.459). No complications attributable to the use of brilliant blue staining were noted.

**Conclusions** Epiretinal membrane surgery with internal limiting membrane removal assisted by brilliant blue staining is a highly effective management for idiopathic epiretinal membranes. Preoperative visual acuity is a moderate predictor of final visual acuity, and highly predictive of the absolute gain in visual acuity following epiretinal membrane surgery using brilliant blue.

## Retina 2

Sunday 16 June

### Paper #133

A randomized controlled trial comparing pneumatic retinopexy versus vitrectomy for the management of primary retinal detachment; anatomical success, functional success and impact on patient quality of life

Roxane J. Hillier, Alan Berger, Filiberto Altomare, David T. Wong, Louis Giavedoni, David Chow, Shelley R. Boyd, Rajeev Muni

**Purpose** To compare outcomes of retinal detachment repair following pneumatic retinopexy (PnR) versus pars plana vitrectomy (PPV) in terms of anatomical success, functional success and patient quality of life.

**Study Design** A REB approved, prospective randomized controlled trial, comparing two surgical interventions. Eligibility criteria: adults patients with primary rhegmatogenous retinal detachment, a single retinal break or group of breaks no larger than one clock hour (30°), all break/s in detached retina to be between 8-4 o'clock and no significant proliferative vitreoretinopathy. A sample size calculation determined that 176 patient were required for this study.

**Primary outcome measure:** visual acuity (VA) (ETDRS) at 12 months post intervention.

**Secondary outcome measures:** VA (ETDRS) at 3 and 6 months post intervention, VA (Snellen) at 1 week, and 1, 3, 6 and 12 months post intervention, subjective visual function (VFQ25) at 3, 6 and 12 months post intervention, subjective health related quality of life (HRQOL) (SF-36) at baseline and 1 month post intervention, anatomical success at 1, 3, 6 months and 12 months post intervention.

**Methods** Eligible patients randomized using a block randomization procedure, stratifying for macular status. Randomized patients underwent PnR or PPV within 24 hours for macula-on detachments and 72 hours for macula-off detachments. Study patients were followed up at 1 day, 1 week, 1 month, 3 months, 6 months and 12 months post intervention. Clinical, OCT and quality of life data was obtained at each time point as described above.

**Results** 38 of 176 patients have been recruited for the study to date. 20 patients have been randomized to PnR and 18 patients have been randomized to PPV. One month anatomic reattachment rates are 14/14 (94%) in the PnR group and 14/14 (100%) in the PPV group (p=1.00 Fisher's exact).

**Conclusions** Preliminary results suggest no statistically significant difference in early primary reattachment rates between PnR and PPV for patients meeting the inclusion criteria for this study.

Retina 2

Sunday 16 June

Paper #134

Combination Therapy for Perfused Central Retinal Vein Occlusion (CVO) Using Intravitreal Ranibizumab and Laser-induced Anastomosis

Brian Leonard, Elena Torlone, Stuart Coupland

**Purpose** Successful CVO bypass occurs after a prolonged interval of vascular remodeling following the initial laser application. We examined the potential for intravitreal ranibizumab to control the CVO macular edema during this interval and thereby limit vision loss from chronic pigmentary maculopathy

**Study Design** Case Series

**Methods** Cases of perfused CVO managed with combination intravitreal ranibizumab and laser-induced anastomosis were reviewed. Laser-induced anastomosis was performed using a published technique that avoids direct vein puncture

**Results** In 28 eyes of 28 patients at least one functioning laser-induced anastomosis was eventually present in each eye. All eyes retained perfused CVO status. Reversal of macular edema with minimal pigmentary maculopathy occurred in 22 of 28 eyes

**Conclusions** Intravitreal ranibizumab appears to protect the macula from pigmentary degeneration secondary to chronic macular edema associated with the prolonged interval of vascular remodeling following venous reperfusion after CVO bypass therapy with laser-induced anastomosis for perfused CVO, and does not appear to interfere with the formation of functioning anastomosis sites

## Uveitis Symposium: Treatment of uveitis

Sunday 16 June

### Paper #135

A national survey of Canadian ophthalmologists to determine awareness of published guidelines for the management of uveitis.

Nima Noordeh, Crystal S. Cheung, Chloe Gottlieb

**Purpose** To assess current awareness of published guidelines for the treatment of uveitis among Canadian ophthalmologists, and to ascertain whether current clinical practice is congruent with published guidelines. Also assessed was the frequency of applications to the public health system for immunomodulatory drugs or biologics, and identification of the primary prescribers of these therapies.

**Study Design** Prospective cross-sectional survey.

**Methods** A 25-item questionnaire with clinical, practice-related patient scenarios was sent to 759 practicing Canadian ophthalmologists. The published uveitis treatment guidelines referenced are those of an international panel of uveitis experts (Jabs et al., 2000). Six questions assessed demographic data, year of residency completion, residency training completed in a program with a uveitis specialist, and fellowship training in uveitis or a related sub-specialty. Seven questions assessed application of the guidelines to clinical scenarios. Twelve questions assessed referral patterns, co-management of therapy and success of obtaining drugs from private and public insurance providers. The data was stratified and responses were compared among groups.

**Results** There were 144 respondents. Twelve respondents (8.3%) were uveitis specialists. A fellowship-trained uveitis specialist was present during residency training for 45.1% of respondents. Correct responses among physicians reporting 1) awareness and 2) utilization of uveitis treatment guidelines was 60.4% in both cases. Seventy five percent of respondents appropriately identified instances where referral to a specialist for immunomodulatory therapy (IMT) is needed. Assessing referrals to uveitis specialists based on year of residency completion, we noted that the most recent graduates (completion of residency training between 2001 and 2012) referred patients to uveitis specialists (55.3%) the least frequently. Recent graduates were more likely to manage uveitis patients with intravitreal or periocular steroids (48.4%) than those graduating before 1980 (10.5%), who reported more frequently using systemic therapies. Eighty-nine percent of respondents submitted less than five IMT funding applications to the public health system yearly, while 4.9% of physicians reported prescribing IMT themselves, rather than referring to other specialists.

**Conclusions** Self-reported awareness of and application of uveitis treatment guidelines were not associated with practice patterns following the published guidelines. Identification of patients

requiring IMT in the clinical practice scenarios was less frequent than self-reported rates of referral to specialists for management of IMT. Few applications are made for IMT and the majority are sent by non-ophthalmologists. This suggests the need for further education of ophthalmologist about uveitis treatment guidelines and the need for more ophthalmologists trained to manage uveitis.

## Refractive Cataract Surgery

Monday 17 June

Paper #136

Practice Patterns of Canadian Ophthalmological Society members in Cataract Surgery - Survey 2013

Lindsay Ong-Tone

**Purpose** This is the fifth annual survey on the practice patterns of the members of the Canadian Ophthalmological Society on cataract surgery.

**Study Design** Web based

**Methods** The current survey will be done in January 2013 when an e-mail with a link to Fluid Surveys will be sent to all the COS members who have indicated that their Practice Focus is on Cataract and IOL. A reminder e-mail will be sent about 3 weeks later.

**Results** The previous surveys have shown some definite trends. There was a moderate increase in the use of toric intraocular lenses to correct astigmatism at the time of cataract surgery. The use of a nonsteroidal anti-inflammatory drug (NSAID) eye drops alone stayed unchanged postoperatively but there was a gradual decrease in the use of steroid only eye drops with a corresponding increase in a combination steroid and NSAID eye drops.

**Conclusions** It would be interesting to see if these trends continue in the 2013 survey.

## Refractive Cataract Surgery

Monday 17 June

Paper #137

Stray light levels of different intraocular lens designs and materials

George Beiko, Patricia Piers, Marrie vanderMooren, Michelle Langeslag

**Purpose** To determine stray light levels for intraocular lenses with different designs and materials.

**Study Design** Laboratory study

**Methods** The stray light levels of IOLs made from 3 different materials and 3 different designs were compared. The IOLs were measured on an optical bench in an eye model. From five line spread functions, obtained by stepwise lateral displacement of the CCD camera, a light intensity vs. angle plot was constructed. This data was used to calculate the angularly dependent stray light parameters for each IOL model for forward scatter positions between 0.6 and 2 degrees. These graphs were compared to a 20 and 70 year old human crystalline lens.

**Results** The stray light levels of all monofocal lenses were below or comparable to the levels measured for a 20 year old human crystalline lens. Hydrophobic acrylic monofocal aspheric lenses have lower stray light levels than monofocal spherical lenses. The stray light levels for monofocal lenses made from silicone were higher than values for lenses from hydrophobic acrylics. Typical values for the stray light of aspheric monofocal lenses at 2 degrees vary from 1.0 to 2.6 while the stray light for a healthy 20 year old crystalline lens is 3.42. Acrylic diffractive multifocal stray light levels are between that of a 20 year old and a 70 year old healthy human crystalline lens.

**Conclusions** Conclusion: IOLs made from hydrophobic acrylics have similar design-dependent stray light levels, with multifocal IOLs having the highest stray light levels followed by monofocal spherical IOLs. Monofocal aspheric IOLs have the lowest stray light levels. Silicone lenses have higher straylight levels than comparable hydrophobic acrylic lens designs. All lenses tested have stray light levels lower than that of a 70 year old healthy human crystalline lens for a forward scatter measured between 0.6 and 2 degrees.

## Refractive Cataract Surgery

Monday 17 June

Paper #138

What is the Quality of Vision and Patient Satisfaction after Multifocal and Multifocal Toric IOLs?

Hamza Khan, Alex Chan

**Purpose** To report the patient satisfaction following different types of multifocal IOLs.

**Study Design** Prospective cohort study of consecutive patients having cataract surgery and multifocal IOL.

**Methods** Comparison groups included standard aspheric multifocal and toric multifocal IOL. All patients undergoing surgery with no ocular comorbidity were enrolled. A quality of vision and satisfaction survey was administered to all patients at the final followup visit.

**Results** In N= 38 eyes followup was obtained to 1 year post-operatively. Quality of vision for near and distance was improved subjectively by the patient self-reports. Patient satisfaction however, on a 5-point scale ranges from 1-5 with a mean of 3.8 in the Toric Multifocal group and 3.5 in the Multifocal group. The result is not statistically significant at the sample size collected to date.

**Conclusions** Both aspheric and toric aspheric multifocal IOLs provide an improvement in patient reported quality of vision. This is better than previously reported results for mono focal toric IOLs or standard mono focal IOLs for near targets. However, satisfaction results vary. This may be due to higher preoperative expectations that are anticipated in this population.

## Refractive Cataract Surgery

Monday 17 June

Paper #139

Determining the rotational stability of a 1-piece hydrophobic-acrylic toric intraocular lens.

Don R. Nixon, Lucas Feuchter, Sanjeev Kasthurirangan, Pamela Smith

**Purpose** To evaluate the rotational stability of the hydrophobic acrylic TECNIS Toric intraocular lens (IOL)

**Study Design** Prospective, interventional, case series (ClinicalTrials.gov NCT01098812)

**Methods** The TECNIS Toric IOL (ZCT) consists of four models with cylinder powers of 1.50 D, 2.25 D, 3.00 D, and 4.00 D in the IOL plane. Patients requiring cataract surgery with keratometric cylinder between 0.75 D and 3.62 D were enrolled in the study and implanted with the appropriate model of the ZCT IOL after completion of standard small incision cataract surgery. Reference marks on the lens allowed axial alignment. High-resolution, slit-lamp retroillumination, digital photographs were taken at 1 day, 1 week, and 1, 3, and 6 months postoperatively. Axis alignment was assessed with the Toric Lens Axis Measurement Program using iris and/or scleral landmarks (nevi, blood vessels, etc.) to align each visit image with the baseline (Day 1) image. Value of degree of rotation was positive (absolute value) whether rotation was clockwise or counter-clockwise. Axial alignment results are reported for all eyes of the 174 enrolled with evaluable images at 2 or more visits.

**Results** Subjects' mean age was  $69.4 \pm 0.80$  (range 41 to 87) years and 54.6% (95/174) of subjects were female. Mean axial rotation was 2.70 degrees  $\pm$  5.51 from 1 day to 6 months (n=156), 1.79 degrees  $\pm$  2.12 from 1 to 3 months (n=156), and 1.89 degrees  $\pm$  2.27 (n=152) from 3 to 6 months. Percent of IOLs rotating  $\leq$  5 degrees was 94.2% (147/156) between 1 day and 6 months, 92.9% (145/156) between 1 and 3 months, and 94.1% (143/152) between 3 and 6 months. Four of 174 eyes (2.3%) had an axis shift at 1 day that required repositioning.

**Conclusions** These data demonstrate a high level of rotational stability for the TECNIS Toric IOL. The results exceed the ANSI toric IOL standard that defines stability as 90% of lenses rotating  $\leq$  5 degrees between visits 3 months apart.

## Refractive Cataract Surgery

Monday 17 June

Paper #140

Intraoperative Wavefront Aberrometry in Refractive Cataract Surgery

Joseph Ma

**Purpose** To evaluate the accuracy and usefulness of intraoperative wavefront aberrometry in comparison to standard methods of partial coherence interferometry and ultrasound biometry in the setting of refractive cataract surgery.

**Study Design** Retrospective Case Series Review

**Methods** A retrospective chart review was conducted on 45 patients who had intra-operative wavefront aberrometry performed prior to optimization. Postoperative refraction at >1 month was compared to predicted postoperative refraction by intraoperative wavefront aberrometry, partial coherence interferometry (2 devices) and ultrasound biometry.

**Results** The mean absolute spherical equivalent error (MAE) between postoperative refraction and predicted refraction by intraoperative aberrometry, partial coherence interferometry (2 devices) and ultrasound biometry were 0.44 D, 0.52 D (device 1), 0.48 D (device 2) and 0.68D. Several outlier clinical cases were identified where intraoperative wavefront aberrometry was especially useful.

**Conclusions** Intraoperative wavefront aberrometry appears to be a useful tool to further refine post-operative cataract refractive results. There are several specific clinical situations where intraoperative wavefront aberrometry can be a significantly more accurate predictor of lens choice, such as in the setting of pre-existing phakic IOLs in patients with staphylomas.

## Refractive Cataract Surgery

Monday 17 June

Paper #141

Outcomes of scleral-fixation of intraocular lenses with fibrin glue

Paul Bastianelli, Salina Teja, Kashif Baig

**Purpose** There are many circumstances that compromise capsular bag integrity, leading to the necessity for intraocular lens (IOL) fixation. The advantages of scleral-fixation of IOLs with fibrin glue include relative surgical ease, minimal intraoperative complications, and stability of the IOL at follow up. Our purpose is to report the anatomic, visual, and refractive outcomes of 10 patients who had scleral-fixation of an IOL with fibrin glue.

**Study Design** Retrospective case series.

**Methods** A review of our first 10 consecutive patients that had scleral-fixation of an IOL with fibrin glue was done retrospectively. The procedure involved the creation of two partial thickness scleral flaps, 3mm from the limbus at 180 degrees from each other. A 3-piece IOL was inserted, with each haptic being externalized through a sclerotomy under the flap and tucked into an intrascleral tunnel. The flaps were then closed with fibrin glue. Operative and post-operative (1-, 3-, and 6- month) outcomes were assessed including complications, centration of IOL, visual acuity, manifest refraction, and endothelial cell count.

**Results** 10 eyes of 9 patients were included in the study. 5 were male and 4 were female with a mean age of 63 years. 8 edematous, pseudophakic bullous keratopathy eyes with poor visibility through the cornea had an IOL exchange procedure in which the offending primary anterior chamber IOL was replaced by a glued IOL, later followed by endothelial keratoplasty (EK). The remaining 2 eyes were treated for traumatic lens subluxation. There were no intraoperative complications, and pain symptoms resolved within one week postoperatively. At 1-month follow up, 9 of 10 eyes had a centered IOL, with the remaining patient having inferior subluxation. One eye with preexisting glaucoma had an IOP rise to 54mmHg, which was managed with topical therapy.

**Conclusions** Scleral-fixation of IOLs with fibrin glue has been reported in a few case series in the literature. We have incorporated this technique into our practice predominantly as a secondary IOL implant procedure in aphakes and as an IOL exchange procedure patients destined for EK. Our preliminary results show positive outcomes with respect to intraoperative complications, IOL positioning, and wound healing, and we will be able to show 6-month follow up visual acuity, manifest refraction, and endothelial cell counts. Our experiences and lessons learned with patient selection, surgical technique, and follow up outcomes of these 10 eyes may encourage the adoption of this useful technique by cataract and anterior segment surgeons.

## Refractive Cataract Surgery

Monday 17 June

Paper #142

Evaluating the safety and efficacy of reverse optic capture for single piece acrylic IOLs

Alex Kaplan, Patrick Gooi, Iqbal Ike K. Ahmed

**Purpose** To evaluate the effectiveness and safety of reverse optic capture of single piece acrylic intraocular lens (IOL) during cases where posterior capsular integrity has been compromised.

**Study Design** This was a retrospective study of 6 patients who underwent reverse optic capture surgery between January 2006 and October 2012.

**Methods** Primary outcomes that were evaluated included effective lens position, postoperative refraction and surgical complications. Effective lens position was measured with anterior segment optical coherence tomography. Patients were monitored for endophthalmitis, retinal detachment, UGH syndrome and IOL dislocation.

**Results** Postoperatively, 75% of patients were left with some residual myopia. The mean numerical error from predicted target was -0.44D. Five of the six cases had no significant postoperative complications. One case developed an unexplained vitreous hemorrhage 48 months postoperatively and was found to have weakened zonules with capsulo-donesis.

**Conclusions** Reverse optic capture in the setting of a compromised posterior capsule may be a safe and effective means of achieving stable fixation of an IOL, assuming zonular integrity is intact. Depending on the IOL power, this may leave patients with some degree of myopia.

## Refractive Cataract Surgery

Monday 17 June

Paper #143

Does Central IOL pitting caused by Yag laser capsulotomy affect the quality of life of the patients

Shahab A. Khan, Osama M. Ahmed, Ravikrishna Nrusimhadevara

**Purpose** To investigate the impact of central IOL pitting by Yag laser capsulotomy on post cataract surgery patients on their day to day life and vision.

**Study Design** A prospective audit of 50 patients with central IOL pitting with yag laser capsulotomy was done.

**Methods** Activities of Daily Vision Scale -Developed by Mangione & colleagues which has been extensively used for studies was modified to add computer usage in it.This Modified ADVS scale questionnaire was given to the patients who had IOL pitting within central 5m.m of IOL caused by Yag capsulotomy. Exclusion Criteria:advanced AMD,Advanced Glucoma,Macular scarring.the results of these were analyzed.

**Results** Improvement in Vision:95%,Day Driving:90%,Night driving:85%,Glare:50%,Brightness of vision:100%,Colours:100%,TV watching:100%,Computer usage:70%

**Conclusions** Central IOL pitting although clinically significant does not have a great impact on the quality of life of the patients .

Retina 3

Monday 17 June

Paper #144

## STEREOTACTIC FRACTIONATED RADIOTHERAPY IN THE TREATMENT OF JUXTAPAPILLARY CHOROIDAL MELANOMA: A LONGITUDINAL STUDY

Fadwa Al Adel, Rolina Al-Wassia, Alan Dal Pra, Christine Corriveau, Pierre Rousseau, George Shenouda, Sonia Callejo

**Purpose** To report the efficacy and complications of linear accelerator-based stereotactic fractionated radiotherapy (SRT) for the treatment of juxtapapillary choroidal melanoma.

**Study Design** Retrospective review.

**Methods** We performed a retrospective review of 55 consecutive patients diagnosed with juxtapapillary choroidal melanoma and treated with linear accelerator-based stereotactic fractionated radiotherapy between April 2003 and March 2012. Patients with small to medium sized lesions (Collaborative Ocular Melanoma Study classification) located within 2 mm of the optic disc were included. The prescribed radiation dose was 60 Gy in 10 fractions. The primary endpoints included local control, enucleation-free survival, and complication rates (dry eyes, neovascular glaucoma, optic neuropathy, radiation retinopathy, cataract).

**Results** Data for 55 patients was gathered. There were 22 males and 33 females, with a median age of 69 years (range, 30-92 years). Eighty percent of the patients had medium sized lesions, and twenty percent of patients had small sized lesions. There were eight cases of recurrence vs. four cases in the previous study (14.5% vs. 7.2%). There were eleven cases of enucleation vs. three cases (20% vs. 6%) in the previous study. Actuarial local control rates at 2 and 5 years were 93% and 82.1%, respectively. Actuarial enucleation-free survival rates at 2 and 5 years were 94% and 73.4%, respectively. In regards to complications, 71% vs. 50% in the previous study had radiation-induced retinopathy; 25% vs. 24% had dry eye; 33% vs. 16% had cataract; 53% vs. 24% had optic neuropathy; and 38% vs. 20% had neovascular glaucoma.

**Conclusions** Linear accelerator-based stereotactic fractionated radiotherapy using SRT offers a non-invasive alternative to enucleation and brachytherapy, is safe and has an acceptable toxicity profile. Tumor recurrence rate using SRT was found to be lower than those reported in the literature for iodine plaque in posterior located tumors but higher than that reported with other forms of linear accelerator-based radiotherapy. Efforts are now in place to further refine the technique to reduce the rate of tumor recurrence.

Retina 3

Monday 17 June

Paper #145

OCT in detecting lipofuscin pigment associated with choroidal melanocytic lesions.

Salah Alrashidi, Hatem Krema, Ronaldo Santiago, Charles Pavlin

**Purpose** To report sensitivity and specificity of optical coherence tomography (OCT) in detecting lipofuscin pigment associated with choroidal melanocytic lesions.

**Study Design** Retrospective case series analysis of consecutive choroidal melanocytic patients with associated lipofuscin pigment presented between July 2011 and October 2012.

**Methods** OCT was performed using Zeiss SD-OCT model 4000 (Meditec, Dublin, CA., USA). Fundus autofluorescence (FAF) was performed to verify presence of lipofuscin for all included patients. Chart review included demographics and clinical tumor features. Images review included, fundus clinical photos, OCT 5-line raster images and corresponding fundus view port images, and FAF images.

**Results** 32 patients met the inclusion criteria. Lipofuscin pigment appeared as reflective clumps in the 5-line raster images in 79% of patients, and as reflective material related to the lesion in 64% in fundus view port images. The location of lipofuscin was on RPE apices in 72% of patients, within SRF in 26%, the undersurface of neuroretina in 67%, and within neuroretina in 25%. All patients who demonstrated evidence of lipofuscin presence on OCT showed a similar appearance with FAF. However, reflective clumps detected with OCT did not always correspond with clinical or FAF evidence of lipofuscin.

**Conclusions** OCT shows high sensitivity in detecting lipofuscin pigment associated with choroidal melanocytic lesions, as verified with FAF. However, it shows limited specificity, since other retinal pathology may produce similar morphology including drusens and RPE changes.

Retina 3

Monday 17 June

Paper #146

Plaque radiotherapy with and without adjuvant laser for choroidal melanoma: 30 years' experience

Nadia Lihimdi, Alain Rousseau, Dan Bergeron, Aissa Iggui

**Purpose** To compare long term effect of combined plaque radiotherapy and laser to plaque radiotherapy alone on regression, recurrence and incidence of metastasis of choroidal melanoma.

**Study Design** Retrospective, observational, comparative case series.

**Methods** We reviewed the records of 124 patients with choroidal melanoma treated with plaque radiotherapy between 1980 and 2008. 79 patients had additional laser (Argon photocoagulation or Diode transpupillary thermotherapy ), 45 patients had plaque radiotherapy alone.

**Results** Tumor regression was substantially more significant in the combined therapy group, with argon and diode evenly, but only during the first 36 month follow-up period. The recurrence rate was 16% over 30 years in both groups. There was no statistical difference in the occurrence of metastasis (25.3% vs. 37.7%,  $p = 0.14$ ) between plaque with or without laser. Moreover, in case of recurrence, the incidence of metastasis was significantly higher in the group treated with plaque alone (66.67% vs. 9.09%,  $p = 0.016$ ). Survival was better in the combined therapy group with a  $p$  value = 0.02.

**Conclusions** Combined therapy provides better regression of choroidal melanoma in the short terme. This effect has not been proven at 30 years follow up. It has no effect on the recurrence rate either. However, we note that in cases of recurrence, the tumour metastasis rate is lower with combined therapy

Retina 3

Monday 17 June

Paper #147

Management of Choroidal Metastases with external beam radiotherapy using a short fractionated schedule.

Juan P. Velazquez-Martin, Somani Sohel, Pedro F. Salazar, David Payne, Normand Laperriere, E. Rand Simpson

**Purpose** To report on the outcomes of choroidal metastasis treatment with a short external beam radiotherapy protocol.

**Study Design** Retrospective case series study.

**Methods** A retrospective electronic chart and imaging database review was conducted for all patients with choroidal metastasis, who underwent clinical examination at the Ocular Oncology Clinic of Princess Margaret Hospital, and were treated with a fractionated radiotherapy protocol of 2000 Gy delivered in 5 fractionated sessions of 4 Gy each over 5 days. Demographic and clinical data were included. Outcome measures included: visual acuity, subretinal fluid status and tumor thickness measured by ultrasound. Evaluations were made at 1, 3 and 12 months after treatment. The last clinical evaluation was also recorded.

**Results** 71 eyes of 55 patients with choroidal metastasis were included. Breast, followed by lung cancer were the most common primary malignancies found to metastasize to the choroid. Mean follow-up was  $12.8 \pm 11.3$  months (range 1-49 months). At the last follow-up, in 31 eyes (44.3%) the VA stabilized, in 25 eyes (35.7%) the VA improved 3 or more lines, 13 eyes (18.6%) lost 3 or more lines of vision, 1 eye (1.4%) had no light perception and 1 eye (1.4%) was treated with enucleation for aggressive disease in an eye without visual potential. Complete subretinal fluid resolution was achieved in 37 (77.1%) of 48 eyes who presented with it at initial evaluation. Four eyes (5.7%) presented new subretinal fluid during follow-up. At the last follow-up, in 47 eyes (67.1%) the ultrasound exam of the metastases was deemed as not readily distinguishable from the normal choroid, or "flat". In the 23 (32.9%) remaining eyes, a mean thickness reduction of  $2.3 \pm 1.58$  mm was obtained. Treatment was well tolerated, with only 5 patients (9.1%) reporting mild transitory dryness. Long-term treatment-related complications included radiation optic neuropathy in 7 eyes (9.9%), pigmentary maculopathy in 5 eyes (7%), cataract in 4 eyes (5.6%), radiation retinopathy in 1 eye (1.4%), and glaucoma in 1 eye (1.4%). Mean survival was  $15.5 \pm 12.6$  months (range 1-49 months). Only 3 patients (5.5%) were alive at the end of the study.

**Conclusions** Choroidal metastases are an ominous sign of advance and aggressive systemic disease. Palliative fractionated radiotherapy dose of 2000Gy, delivered in 5 sessions seems to be as effective as historically reported protocols lasting 4 weeks (20 sessions), for the management of choroidal metastases. This approach improves the patients' quality of life rapidly, reduces the number of hospital visits and subsequently reduces healthcare costs.

Retina 3

Monday 17 June

Paper #148

Segmental reproducibility of blood flow velocity measurement using the retinal function imager (RFI).

Rayan A. Alshareef, Jay Chhablani, Sami Rezeq, Sunir J. Garg, Dirk-Uwe Bartsch, Igor Kozak, Andre J. Witkin, Zvia Burgansky-Eliash, Kapil Sampat, William Freeman

**Purpose** To evaluate the reproducibility of blood flow velocity measurements of individual retinal blood vessel segment using the retinal function imager.

**Study Design** Prospective, multicenter study.

**Methods** : Eighteen eyes of 15 healthy subjects were enrolled prospectively at three centers. All subjects underwent RFI imaging in two separate sessions 15 minutes apart by a single experienced photographer at each center. An average of 5-7 serial RFI images were obtained. All images transferred electronically to one center and were analyzed by a single observer. Multiple blood vessel segments (each less than 100 microns) were drawn and were overlaid onto the second session images by using built-in software. The inter-session reproducibility of flow velocity was assessed by the concordance correlation co-efficient (CCC), coefficient of reproducibility (CR) and coefficient of variance (CV).

**Results** Inter-session CCC for flow velocity was 0.97 (95% Confidence Interval (CI), 0.966 to 0.9797). The CR was 1.49 mm/sec (95% CI, 1.39 to 1.59 mm/sec) and CV was 10.9%. The average arterial blood flow velocity was 3.16 mm/sec, and average venous blood flow velocity was 3.15 mm/sec. The CR for arterial and venous blood flow velocity was 1.61 mm/sec (95% CI, 1.47 to 1.74 mm/sec) and 1.27 mm/sec (95% CI, 1.14 to 1.41 mm/sec) respectively.

**Conclusions** Conclusion: RFI provides reproducible measurements for retinal blood flow velocity for individual blood vessel segment with 10.9% variability. Better knowledge of retinal blood flow velocity of individual segment will be helpful to better understand the pathophysiology of the structural changes in the retina in various ocular and systemic disorders.

Retina 3

Monday 17 June

Paper #149

Optical coherence tomography-based correlation between choroidal thickness, drusen load, and plasma cytokines in dry age-related macular degeneration.

Ashley S. Ko, Sijia Cao, Kaivon Pakzad-Vaezi, Penelope Brasher, Andrew Merkur, David Albani, Andrew Kirker, Jing Cui, Joanne Matsubara, Farzin Forooghian

**Purpose** Spectral-domain optical coherence tomography (SD-OCT) can be used to measure choroidal thickness and drusen load. We investigated the correlation between these parameters in patients with dry age-related macular degeneration (AMD). The relationship of choroidal thickness and drusen load with systemic inflammatory cytokines and genotype was also investigated.

**Study Design** Cross-sectional study.

**Methods** Forty-four patients with dry AMD were recruited. Drusen area and volume were determined using the SD-OCT software, and choroidal thickness was measured using enhanced depth imaging (EDI). The subjects' blood samples were analyzed for multiple cytokines using Bio-Plex suspension assays and genotyped for the CFH Y402H single nucleotide polymorphism. Statistical analyses were conducted using ANCOVA and multivariable regression.

**Results** We found an inverse correlation between choroidal thickness and drusen load ( $r = -0.35$ ,  $p = 0.04$ ). Drusen load also correlated with logMAR visual acuity ( $r = 0.32$ ,  $p = 0.04$ ). A correlation between choroidal thickness and logMAR visual acuity was suggested ( $r = -0.22$ ,  $p = 0.21$ ). Patients with the high-risk CC variant had higher levels of plasma cytokines than those with TT variant (IL-1 $\beta$ , IL-1ra, IL-4, IL-5, IL-6, IL-7, IL-9, IL-10, IL-17, G-CSF, IFN- $\gamma$ , MIP-1 $\alpha$ , TNF- $\alpha$  and VEGF) ( $p \leq .05$ ). MIP-1 $\beta$  showed a negative relationship with choroidal thickness ( $\beta = -.35$ ,  $p = .05$ ). No correlation was found between the tested cytokines and drusen load.

**Conclusions** Drusen load and choroidal thickness are correlated in dry AMD. Furthermore, both drusen load and choroid thickness are correlated to visual acuity. The CFH Y402H genotype is associated with elevated systemic levels of inflammatory cytokines. These findings provide support for the role of inflammation in the pathogenesis of AMD. The change in RPE-choroid interface may be associated with the systemic inflammatory cytokines. Therefore, the measurement of these outcomes may serve as important outcome parameters in routine clinical care and in clinical trials for dry AMD.

Retina 3

Monday 17 June

Paper #150

Optical Coherence Tomographic patterns in Diabetic Macular Edema: Prediction of outcome after Intravitreal Triamcinolone Acetonide (Triesence®) injection M. Al-Abri, MD1, A. Al-Hinai, MD1, Huda Al-Waili, MD2 1Department of Ophthalmology, Sultan Qaboos University Hospital, Oman 2Resident, Ophthalmology Residency Program, Oman

Mohamed Al-Abri, Ahmed Al-Hinai, Huda Al-Waili

**Purpose** To identify optical coherence tomographic (OCT) patterns of diabetic macular edema (DME) predictive of anatomical and visual outcomes after intravitreal triamcinolone acetonide (Triesence®) injection.

**Study Design** Retrospective interventional study.

**Methods** Electronic medical records for 25 eyes of 25 patients were respectively reviewed. Each subject was classified to as one of three DME types according to the OCT features: diffuse retinal thickening (DRT), cystoid macular edema (CME), serous retinal detachment (SRD). Baseline best-corrected visual acuity (BCVA), intraocular pressure (IOP), lens status and macular OCT features were recorded. Subjects were given one intravitreal injection of triamcinolone acetonide (2 mg in 0.05 ml). The clinical course of BCVA, IOP, lens changes and central foveal thickness (CFT) using spectral domain OCT were monitored for minimal of 3 months after the injection.

**Primary Outcome measures:** Mean visual acuity gain and mean reduction in central foveal thickness.

**Secondary Outcome:** Changes in IOP and lens.

**Results** The mean follow-up period, the mean visual acuity gain in each group (lines on an ETDRS charts) and the mean foveal thickness reduction will be analyzed. Moreover, changes in IOP and any lens changes will be reported. (Subjects still did not complete the minimal follow up period).

**Conclusions** Will be presented. (Subjects still did not complete the minimal follow up period).

## Vision Rehabilitation

Monday 17 June

### Paper #152

Perceptual learning with threshold stimuli improves visual performance in patients with central vision loss

Martin J. Steinbach, Luminita Tarita-Nistor, Michael H. Brent, Samuel N. Markowitz, Esther G. Gonzalez

**Purpose** To evaluate the effectiveness of a perceptual learning technique in improving reading performance of patients with central vision loss, and to explore whether learning generalizes to other visual functions.

**Study Design** Prospective, case series

**Methods** Ten patients with central vision loss (mean age, 72.6 years) were trained binocularly in 4 consecutive sessions with serially presented words printed at each patient's reading acuity limit and projected in the middle of a computer screen. Patients were required to read 10 blocks of 100 words in each session. Assessment sessions before and after training measured fixation stability, monocular and binocular visual acuity, as well as reading acuity, critical print size, and maximum reading speed with continuous text.

**Results** The average time required to read a block of trials decreased significantly with each training session. After training, continuous text reading improved in terms of reading acuity ( $p = .017$ ) and maximum reading speed ( $p = .01$ ), but critical print size did not change. Binocular acuity improved significantly from an average of .54 logMAR before training to .44 logMAR after training. Binocular ratio increased from an average of 1 before training to 1.17 after training. There was a 62% improvement in fixation stability in the better eye and 58% in the worse eye.

**Conclusions** Perceptual learning with serially presented words is a useful technique for vision rehabilitation of patients with central vision loss. When training is done with threshold stimuli, learning generalizes to visual acuity, continuous text reading, and fixation stability.

## Vision Rehabilitation

Monday 17 June

Paper #153

The worse-seeing eye in AMD is not as bad as it seems to be

Dominik W. Podbielski, Sophia Reyes, Samuel N. Markowitz

**Purpose** Routine residual vision assessment is focused in clinical practice mostly on the better-seeing eye. The worse-seeing eye is usually discounted in terms of usefulness. This approach is based mostly on estimates of residual visual acuity. In many cases the assessment is also not based on best corrected visual acuity protocols. Residual visual acuity was shown to be an unreliable indicator of true residual vision abilities. Fixation stability at eccentric preferred loci in cases with loss of macular function was shown to be a better indicator of true residual vision abilities. Hence the present work is focused on assessment of residual visual functions with modern parameters in cases with AMD with emphasis on the worse-seeing eye.

**Study Design** This is a retrospective chart review of cases who attended a specialized low vision clinic.

**Methods** Ethics Board approval was obtained and patients signed an informed consent. Included were cases with diagnosed AMD of all age groups and all visual acuity levels. Assessment included an interview for reviewing demographics, as well as assessment of ETDRS visual acuity, potential visual acuity and contrast sensitivity. Assessments of PRL location, fixation stability at the PRL and fixation pattern were obtained with the Nidek MP-1 microperimeter. Outcome measures selected for analysis were Visual acuity, PRL location, fixation stability, PRL span and potential visual acuity.

**Results** We collected data on both eyes on 69 AMD low vision patients. Out of those, 54 had complete data for the two eyes. There were 25 males and 29 females whose mean age was 84 (+/- 7) years of age.

Out of the 54 patients, 29 had retina corresponding PRLs in both eyes and 25 had non-corresponding PRLs. Mean ETDRS visual acuity in the better eye was  $0.75 \pm 0.29$  logMar and  $1.2 \pm 0.39$  logMar in the poorer eye ( $p < 0.0001$ ). Mean BCEA was  $10.58 \pm 25.15$  degrees squared in the better eye and  $12.11 \pm 21.68$  degrees squared in the poorer eye ( $p = 0.68$ ). Fixation span in the better eye was  $5.06 \pm 4.25$  degrees while in the poorer eye it was  $5.58 \pm 3.94$  degrees ( $p = 0.42$ ). Mean BCEA in better-seeing eyes was not different between cases with PRL retinal correspondence and cases with PRL retinal non-correspondence ( $p = 0.90$ ). Same was for BCEA for the worse-seeing eye ( $p = 0.12$ ).

**Conclusions** The worse-seeing eye in cases with AMD seems to be not as bad as thought and in most cases not much different than the better-seeing eye. Assumptions based solely on visual acuity estimates seem to mislead in this aspect. Hence the need to include the worse-seeing eye in all assessment protocols for residual vision and in all low vision rehabilitation plans.

## Vision Rehabilitation

Monday 17 June

Paper #154

Determinants in access to low vision services - a Montreal retina study

Alice Y. Zhang, Donald H. Watanabe, Walter Wittich, Christian El-Hadad, Salim Korban, Julius E. Gomolin, Olga Overbury

**Purpose** Patients with vision impairment should be referred to low vision clinics or rehabilitation agencies by eye-care professionals. However, various factors may hinder their decision to access low vision rehabilitation services. We investigate the determinants that may influence such a decision in patients from a Montreal retina practice.

**Study Design** Retrospective chart review

**Methods** 8,643 patient records from one medical retina specialist's practice at a large academic institution were reviewed, spanning 26 years from 1985 to 2011. We identified 525 referrals to the MAB-Mackay Rehabilitation Centre (MMRC), one of the two major centers that provide vision rehabilitation services in the Greater Montreal Area. Demographic and clinical characteristics, such as age at time of referral, gender, visual acuities at time of referral, year of referral, diagnosis, and distance from the MMRC, were collected and analyzed for relationships to successful access to low vision services.

**Results** Of the 525 patients referred to the MMRC, the retina specialist successfully obtained compliance from 77% of patients. Of those referred, 375 patients had a diagnosis of age-related macular degeneration (AMD), 97 had diabetic retinopathy, and 53 had other ocular conditions. Data analysis showed that there is an association between distance from MMRC and utilization of low vision rehabilitation services,  $p < .05$ ; patients who lived farther away were more likely not to access the MMRC. Analysis also demonstrates that patients referred from the years 2005-2009 were more likely to access low vision rehabilitation compared to those from other time periods,  $X^2(3) = 29.393$ ,  $p < .0001$ . However, factors such as diagnosis, visual acuity, level of visual impairment, age, and gender were not related to whether or not an individual sought assistance from a low vision rehabilitation center.

**Conclusions** The Montreal Barriers Study reported that 54% of people who were eligible for rehabilitation services actually received them. The source of participants was much broader including ophthalmologists in all subspecialties, other than pediatrics. This study demonstrates a higher success rate (77%) of utilization of low vision rehabilitation services. It is conceivable that a retina specialist would be more likely to refer patients and that the recommendation may be more seriously considered. Moreover, following the advent of anti-VEGF intravitreal injections for AMD in 2005, it is possible that more frequent patient-physician contact encouraged a therapeutic rapport that led to increased compliance rates to low vision services.

## Vision Rehabilitation

Monday 17 June

### Paper #155

A randomized controlled trial of eccentric viewing training vs. Closed Circuit Television use for visual rehabilitation from age-related macular degeneration

Francie F. Si, Susan Leat, Deborah Gold, Dawn Pickering, Julia Baryla, Keith Gordon, William Hodge

**Purpose** In addition to optical devices, CCTV and EV training are both recognized interventions to improve reading performance in people with AMD. However, both are relatively expensive either in cost of the device or in the time of personnel. Our objective in this pilot randomized trial was to compare the effectiveness of these two interventions with 30 participants.

**Study Design** Randomized clinical trial.

**Methods** Participants with AMD and visual acuity between 20/160 and 20/400 first received basic low vision care, including optical devices. After a period of at least 2 weeks, they took part in a battery of baseline measures including logMAR VA, reading speed and accuracy for 1.3M and 1M text, reading information on medicine bottles, utility bills and food packages, the VFQ-25, Geriatric Depression Scale and a reading inventory questionnaire. Then they were randomized to either obtaining a CCTV for home use or receiving EV training over the following 6 weeks.

**Results** Recruitment was more difficult than expected in this older population. Of 145 patients referred during a 2 year time period, 35 were AMD patients, 14 met the inclusion /exclusion criteria and 10 were finally enrolled and completed the trial. However, for the main outcome variable (reading speed for 1.3M print), there was a significant difference between baseline and outcome for the CCTV group ( $p=0.005$ ), but not for the EV group ( $p=0.28$ ) and the CCTV group showed significantly greater improvement than the EV group ( $p=0.04$ ). There was also a borderline improvement in reading speed for 1M text and a significant decrease in the time taken to read utility bill information in the CCTV group. The other measures did not reach significance.

**Conclusions** Randomized clinical trials for LV rehabilitation, particularly in the elderly population, are challenging, but such trials are important for allocation of resources. This pilot trial did show early indications of more impact from CCTV than EV training.

International Ophthalmology

Monday 17 June

Paper #156

Power analysis and type II errors in recent ophthalmology research

Zainab Khan, C. Jordan Milko, Ayaz K. Kurji, Munir Iqbal, Karim Rahim, David Almeida

**Purpose** Prospective clinical trials are used to make important clinical decisions that impact patient care. Results from literature are usually said to be not statistically significant when they yield a  $p$  value  $>0.05$ . This conclusion may be inaccurate if studies are powered inadequately, resulting in the occurrences of type II errors. The purpose of this study was to examine the power of unpaired t-tests when these tests failed to detect a statistically significant difference and to determine the frequency of type II errors in recently published prospective randomized trials from 4 major ophthalmology journals.

**Study Design** Systematic review and meta-analysis

**Methods** We examined all prospective randomized trials published between 2010 and 2012 in four major ophthalmology journals (Archives of Ophthalmology, British Journal of Ophthalmology, Ophthalmology and American Journal of Ophthalmology). Studies that used unpaired t-tests were included. Power was calculated using the number of subjects in each group, standard deviations and  $\alpha = 0.05$ . The difference between control and experimental means was set to be (1) 20% and (2) 50% of the absolute value of the control's initial conditions. Power and Precision version 4.0 software was used to carry out calculations. Finally, the proportion of articles with type II errors was calculated.  $\beta=0.3$  was set as the largest acceptable value for the probability of type II errors.

**Results** 280 articles were screened. Final analysis included 50 randomized control trials using unpaired t-tests. The median power of tests to detect a 50% difference between means was 0.9 and was the same for all four journals regardless of the statistical significance of the test. The median power of tests to detect a 20% difference between means ranged from 0.26 to 0.9 for the four journals. The median power of these tests to detect a 50% and 20% difference between means was 0.9 and 0.5 for tests that did not achieve statistical significance. A total of 14% and 57% of articles with negative unpaired t-tests contained results with  $\beta>0.3$  when power was calculated for differences between means of 50% and 20%, respectively.

**Conclusions** A large portion of studies demonstrate high probabilities of type II errors when detecting small differences between means. The power to detect small difference between means varies across journals. It is, therefore, worthwhile for authors to mention the minimum clinically important difference for individual studies. Journals can consider publishing statistical guidelines for authors to use.

International Ophthalmology

Monday 17 June

Paper #157

The current landscape of ophthalmology manpower in Canada

Yvonne M. Buys, Lorne Bellan, Lynda Buske, Susan Wang

**Purpose** Physician population density is usually provided on a national level however for countries such as Canada where the population is unevenly distributed over a large geographic area a national ratio may misrepresent what is happening on a more local level. We describe the current population density of ophthalmologists in Canada, on a national, provincial/territorial and regional level.

**Study Design** Cross-sectional, study.

**Methods** The CMA database was used to determine the number and location of currently licensed ophthalmologists in Canada. Using Statistics Canada population data the ratio of ophthalmologists to 100,000 population was determined on a national, provincial and regional basis.

**Results** From the CMA masterfile active physician counts from January 2012, there were 1164 physicians who were certified as ophthalmologists by either the Royal College of Physicians and Surgeons of Canada or the Collège des médecins du Québec. This represents 3.35 ophthalmologists per 100,000 population on a national level or one ophthalmologist per 29,859. There was however significant regional disparity with provincial ratios varying from 5.40 (Nova Scotia) to 1.96 (Saskatchewan) while in the territories the ratio was 0.89. Compared to the national average, 4 provinces (Nova Scotia, British Columbia, Prince Edward Island and Quebec) were above the average with the remaining 5 provinces and the territories being below the national average. Statistics Canada uses census metropolitan areas or census agglomerations to define regions that are economically and socially integrated. Of the 104 areas with at least one ophthalmologist, 22 areas (21%) had a ratio below 3 ophthalmologists per 100,000 (1.57-2.95). Those communities with one ophthalmologist ranged from populations of 16-63,000 and those with two from 14-90,000. There were no communities of less than 30,000 with 3 ophthalmologists and no communities of less than 35,000 with 4 or more ophthalmologists. Of those communities with at least 40,000 people, Rimouski, Quebec and Duncan, British Columbia had the highest ratios with 13.8 and 11.6 ophthalmologists per 100,000 population respectively. 43 areas did not have an ophthalmologist.

**Conclusions** Although on a national level the population density of ophthalmologists in Canada is likely satisfactory, there is significant regional variation. Better mechanisms are required to maintain similar statistics which could facilitate recruiting newly graduating ophthalmologists to

areas with a shortage. In addition development of innovative health care delivery strategies, increasing regional outreach service programs such as the eye van and further developments with telemedicine should be supported.

Monday 17 June

Paper #158

Reduced social participation among seniors with non refractive vision problems and glaucoma

Yaping Jin, Elizabeth Badley, Monique Gignac, Yvonne M. Buys, Kednapa Thavorn, Graham E. Trope

**Purpose** Lack of social integration is associated with increased risks of mortality and dementia. Using a population-based sample we assessed whether vision problems or glaucoma affect senior's engagement in a wide range of social activities.

**Study Design** Cross-sectional survey.

**Methods** We compared participation in 8 community activities from the Canadian Community Health Survey Healthy Aging 2008/09 in people with and without non refractive vision problems (i.e. unable to see with eyeglasses or contact lenses) and those with and without glaucoma. Caucasian respondents aged 65 years or older (n=14,925) were included.

**Results** Participation in sports or physical activities was reduced by nearly half in seniors with vision problems (18.2%) versus those without vision problems (34.7%,  $p < 0.05$ ) and by 7% in those with glaucoma (27.9%) compared to non-glaucoma (34.7%,  $p < 0.05$ ). Participation in family or friendship activities outside the household was also significantly reduced by 12% to 41.4% for seniors with vision problems and by 6% to 47.4% for those with glaucoma. Significantly reduced participation was also seen in volunteer or charity activities (14.7% vs 26.0%), educational or cultural activities (14.9% vs 25.8%), and service club or fraternal organization activities (12.3% vs 19.3%) for people with vision problems but not those with glaucoma.

Participation in church or religious activities and in neighborhood or professional association activities was very similar in people with and without vision problems ( $p > 0.05$ ) and those with and without glaucoma ( $p > 0.05$ ).

When the effects of age, sex, education, income and other chronic conditions were controlled for, seniors with vision problems but without glaucoma were three times more likely not to be involved in any activities (odds ratio (OR) 3.0, 95% confidence interval (CI) 1.7-5.3), and seniors with both vision problem and glaucoma were two times more likely not to participate (OR 2.1, 95% CI 0.7-5.8) compared to seniors with no vision problems and no glaucoma.

**Conclusions** Significant reduction in social participation was found in 6 out of 8 community activities among seniors with vision problems and in 2 out of 8 activities among those with glaucoma. Future research is needed to determine if better social support (like that provided by religious or community groups) can help seniors with vision problems or glaucoma maintain their social participation.

Monday 17 June

Paper #159

The global burden of visual difficulty

Ellen E. Freeman, Marie-Hélène Roy-Gagnon, Elodie Samson, Slim Haddad, Marie-Josée Aubin, Claudia Vela, Maria Victoria Zunzunegui

**Purpose** Using a world-wide, population-based dataset of adults, we sought to determine the frequency of far visual difficulty and its associated risk factors.

**Study Design** Population-based, multi-site, cross-sectional study

**Methods** The World Health Survey (WHS) was conducted in 70 countries throughout the world in 2003 using a random, multi-stage, stratified, cluster sampling design of adults ages 18 years and older. Far vision was assessed by asking "In the last 30 days, how much difficulty did you have in seeing and recognizing a person you know across the road (i.e. from a distance of about 20 meters)?" Responses included none, mild, moderate, severe, or extreme/unable. The income status of countries was estimated using gross national income per capita data from 2003 from the World Bank. Estimates were adjusted to account for the complex sample design.

**Results** 21% of adults reported any visual difficulty. The rate varied by the income status of the country with the percentage who had any visual difficulty being 24%, 23%, and 13% in low, middle, and high income countries, respectively. Five percent of people reported severe or extreme visual difficulty with rates in low, middle, and high income countries of 6%, 5%, and 2% respectively. Risk factors for visual difficulty included older age, female sex, poorer socioeconomic status, little to no formal education, and diabetes ( $P < 0.05$ ).

**Conclusions** One out of five adults in the WHS reported some degree of far visual difficulty. Given the importance of vision to living an independent life, vision health must receive more attention, especially in low and middle income countries.

International Ophthalmology

Monday 17 June

Paper #160

Health Human Resources Projections for Ophthalmology in Canada

Lorne D. Bellan, Yvonne M. Buys, Lynda Buske

**Purpose** In 2007 it was projected that the ratio of ophthalmologists to patients over 65 was declining and was projected to fall by 43% by 2021. Since then several variables involved in the model have changed: more residents are training per year and fewer ophthalmologists are retiring or emigrating to the United States per year. A new projection was undertaken using the most up to date variables and the latest population projections to better predict the numbers of ophthalmologists up to 2030.

**Study Design** Time series forecasting study

**Methods** The CMA database was used to determine the number of currently licensed ophthalmologists in Canada. Using Statistics Canada population data the ratios of ophthalmologists to 100,000 population and to 1000 people over 65 years of age were determined on a national basis. Physician supply projections were determined using the Canadian Medical Association Physician Resource Evaluation Template.

**Results** In January 2012 the CMA masterfile listed 1164 active physicians who were certified as ophthalmologists by either the Royal College of Physicians and Surgeons of Canada or the Collège des médecins du Québec. This represents 3.35 ophthalmologists per 100,000 population or one ophthalmologist per 29,859. It is estimated that the total number of ophthalmologists in 2030 will increase by 21.1% (1.17% per year) from the current number to 1410. Using the medium growth scenario the Canadian population is projected to grow by 19.54% (1.09% per year) over the same period resulting in a slight increase in the number of ophthalmologists per 100,000 population from 3.35 to 3.38. Full-time equivalent ratios, however, fall from 3.29 to 3.06. If the ratio is calculated using only the population aged 65 years or older the ratio falls from 22.5 ophthalmologists per 1,000 population over 65 in 2012 to 14.8 in 2030, a decrease of 34% due to a projected 84% increase in the number of seniors.

**Conclusions** The unprecedented increase in the population over 65 years of age by 2030 that is being projected will cause the ratio of ophthalmologists to population over 65 to drop by one third by 2030. While this drop is not as severe as was predicted in 2007, it still will likely have a significant impact on the delivery of eye care in Canada since the majority of vision threatening conditions afflict the elderly.

Neuro-ophthalmology-1

Monday 17 June

Paper #161

Alexia without agraphia with and without hemianopsia

Amadeo Rodriguez

**Purpose** To describe the presentation of alexia without agraphia with and without hemianopsia, and the possible underlying pathophysiology

**Study Design** Observational, descriptive.

**Methods** Two patients presented with difficulty reading. One had a lesion in the left occipital lobe with extension to the splenium of the corpus callosum and right homonymous hemianopsia. The other patient had a lesion in the left fusiform gyrus without visual field loss.

**Results** Both patients presented alexia without agraphia. Whereas in the first patient a disconnection of visual input and left angular gyrus seems plausible, in the second patient the possibility of word form agnosia is considered more appropriate.

**Conclusions** Alexia without agraphia is a condition that although uncommon, can have devastating consequences. The presence of hemianopsia is not a constant feature. Patients with reading problems often present to ophthalmologists and thus it is important to be aware of this condition and its possible mechanisms.

Neuro-ophthalmology-1

Monday 17 June

Paper #162

Epidemiology and cerebrovascular manifestations of giant cell arteritis in a Canadian population

Rustum Karanjia, Jennifer Gao, Darrell Lewis, Danah Al-Breiki, Vivek Patel

**Purpose** To characterize the incidence and epidemiology of biopsy-proven giant cell arteritis (GCA) in a Canadian population. In addition we aimed to identify potential demographic, clinical, or serological features associated with a high risk of developing intracranial involvement in GCA.

**Study Design** Retrospective cohort review

**Methods** A retrospective chart review was performed on consecutive patients who underwent temporal artery biopsy from August 1, 2007 to August 31, 2011 under the care of a single physician in a Canadian tertiary care institution. We identified patients within this cohort who were diagnosed with biopsy-proven GCA and patients who developed cerebrovascular ischemia (CVI). Demographic, clinical, and serological data were gathered and analyzed.

**Results** Two hundred and eighty three patients underwent temporal artery biopsies during the study period of which 90 (38.1%) patients were biopsy positive for GCA. Mean age of biopsy-positive patients ( $74.5 \pm 8.4$  years) was significantly higher than biopsy-negative patients ( $70.7 \pm 11.2$  years,  $p < 0.01$ ). The biopsy-positive group had a significantly higher platelet count than the biopsy-negative group ( $p < 0.01$ ). There was no difference in ESR or CRP between the groups. The ethnic origins of the biopsy-positive patients were Northern European (86%), West Asian (4%), Arab (3%), Southern European (3%), Hispanic (3%), Eastern European (1%), and Caribbean (1%). Of the biopsy-proven GCA patients, 9 (9.5%) patients experienced a cerebrovascular event: 6 of these patients presented with vasculitic involvement of anterior and posterior circulations, while 3 patients experienced an ischemic event confined to the vertebrobasilar territory. There was no significant difference in age, gender, symptoms, ESR, CRP, and platelet count between biopsy positive patients who experienced CVI and biopsy positive patients who did not experience CVI.

**Conclusions** This is the first study looking at epidemiological data and demographics of GCA in a Canadian population. Our data support the notion that thrombocytosis is a predictor of positive biopsy and that GCA is a disease that predominantly affects older patients of Northern European descent, although it is not limited to this demographic, underscoring the need to maintain diagnostic suspicion for individuals of other backgrounds. No single demographic, clinical, or serological feature was shown to predict the occurrence of CVI in GCA patients. Accordingly, high index of suspicion for GCA needs to be maintained for patients presenting with stroke symptoms, as well as awareness of potential CVI in GCA patients.

Neuro-ophthalmology-1

Monday 17 June

Paper #163

What are the Incidence, Neurologic Morbidity and Mortality of Patients with Terson syndrome in Hamilton Ontario?

Gamal Seif, Amadeo Rodriguez, Kesava Reddy

Purpose To perform a systematic evaluation of the incidence, neurologic morbidity and mortality of patients with Terson syndrome in Hamilton Ontario.

Study Design Prospective case control study

Methods Consecutive patients admitted to the Hamilton General Hospital (HGH) with a diagnosis of spontaneous subarachnoid hemorrhage (SAH) were targeted for inclusion in the study. All patients with intracranial bleeding other than aneurysmal SAH were excluded. Patients with other potential causes of retinal/vitreous hemorrhage (i.e. severe diabetic retinopathy, malignant hypertension, sickle cell, central retinal vein occlusion, etc.) were also excluded. Fundoscopic examinations of all included patients were performed within 2 weeks of their SAH (except for 2 patients that were seen within 4 weeks). The following outcome measures were collected: 1) The presence or absence of retinal or vitreous hemorrhages centered around the optic disc; 2) The Glasgow Coma scale (GCS), Hunt and Hess scale (H&H) and SAH Fisher score upon admission to hospital; 3) the Modified Rankin score upon discharge; and 4) all cause mortality. Statistical analysis was performed by using multiple unpaired T-test, thus a p value of equal or less than 0.0125 (0.05/4) was considered to be statistically significant.

Results A total of 24 patients were included from June 2012 to November 2012. Six of those patients had Terson syndrome (25%). The average H&H, GCS and Fisher scores were 4.2, 6.5, 4.0 for patients with Terson syndrome vs. 2.4, 12, 3.4 for patients without Terson syndrome ( $p = 0.008$ ; 0.016 and 0.013) respectively. The average Rankin score was 5.8 for patients with Terson syndrome vs. 3.7 for patients without Terson syndrome ( $p = 0.0001$ ). Five out of the 6 Terson syndrome patients did not survive whereas 2 out of 18 non-Terson syndrome patients did not survive (OR,40; 95% CI, 2.96-539.67).

Conclusions The results of this study suggest that approximately one quarter of patients admitted to the HGH with SAH have Terson syndrome. Patients with Terson syndrome have a statistically worse H&H score upon admission to hospital and Modified Rankin score upon discharge. Mortality is significantly greater amongst patients with Terson Syndrome. Thus this study demonstrates that Terson Syndrome is not rare and that it does carry a worse prognosis. Based on this data, more awareness of this condition is required within the medical community as it may be used in future to better understand the prognosis of patients with SAH.

Neuro-ophthalmology-1

Monday 17 June

Paper #164

Ocular neuromyotonia: Clinical variants, proposed mechanisms and treatment

Gillian Roper-Hall, Sophia M. Chung

**Purpose** Ocular neuromyotonia is a rare but distinctive clinical entity characterized by spontaneous episodic ocular deviations accompanied by diplopia. The purpose of this study was to identify patients in our practice with ONM and review data to compare ocular movement characteristics, clinical course and treatment outcomes. To investigate underlying mechanisms causing ONM.

**Study Design** A retrospective chart review was conducted on all patients with ONM seen in the past 15 years. The study was approved by the Institutional Review Board at our university and met the HIPAA requirements.

**Methods** All patients with ONM were selected. Presenting signs, clinical characteristics, treatment methods and outcomes in each patient were compared.

**Results** Ten patients were identified with ONM, six with vertical and four with horizontal deviations. Most episodes occurred every 20-40 minutes, lasted a few seconds to several minutes, and continued all day. Vertical muscles affected were superior oblique (3), inferior rectus (2), and superior rectus (1). ONM affected the lateral rectus in four cases. Four patients had tumors (brain (2), lung (1), breast (1)), two patients had thyroid eye disease; the remaining patients had no known underlying neurologic or systemic illness. One patient presented with superior oblique myokymia and subsequently developed ONM. Only two patients underwent radiation to the head.

Membrane stabilizing medication was prescribed in seven of the ten patients with varied success. Extraocular muscle surgery eliminated ONM in one patient with thyroid eye disease.

**Conclusions** Clinical presentation varies among patients with ONM. Selected techniques may be used to identify and document the clinical features.

Proposed mechanisms include ephaptic transmission. Medical treatment is indicated and usually effective.

## Cornea-Controversies in Refractive Surgery

Monday 17 June

Paper #165

Excimer ablation of collagen-based corneal substitutes: one step closer to an 'artificial cornea'

Silvia Odorcic, Christopher Noel, Debbie Mitra, David Priest, Sabrina Taylor, Rejean Munger, May Griffith, W. Bruce Jackson

**Purpose** Biosynthetic corneal hydrogels have already undergone successful implantation in human patients with keratoconus and may one day serve as useful alternatives to human donor tissue for surgical and refractive procedures. For synthetic materials to be biocompatible, they should undergo laser ablation in a consistent and reproducible manner. The purpose of our study was 1) to determine the feasibility and consistency of excimer ablation of collagen-based corneal biomimics (hydrogels), 2) to compare the ablation rates of hydrogels with different mechanical properties.

**Study Design** Prospective comparative study of four different hydrogel formulations (n=12) undergoing excimer ablation.

**Methods** Twelve samples of four different hydrogel formulations (10% recombinant porcine collagen) underwent identical excimer ablations (125  $\mu$ m PTK, 6.0 mm). All hydrogels were cross-linked using a carbodiimide (EDC), epoxy-based cross-linker (BDDGE) or combination (hybrid) to enhance their mechanical properties. Hydrogel ablations were captured using a high resolution camera (optical profilometry). Custom software was used to extract ablation rates by analyzing silhouette images of hydrogels undergoing ablation.

**Results** All hydrogels were amenable to excimer ablation. Ablation rate was plotted against total ablation time for all samples. Hydrogels cross-linked with EDC exhibited extremely consistent ablation rates with minimal inter-sample variability during all time points relative to total ablation time. Hybrid hydrogels (EDC+BDDGE) exhibited moderate ablation consistency between samples, while those cross-linked with BDDGE alone displayed the poorest consistency in ablation rates. The ablation rate of hybrid hydrogels was almost twice as fast as that of EDC cross-linked samples. Hybrid hydrogels also had the most optimized mechanical properties (highest tensile strength and elasticity).

**Conclusions** Cross-linked biosynthetic hydrogels can undergo excimer ablation and therefore fulfill one important requirement of synthetic corneal substitutes: biocompatibility. By tailoring the hydrogel's mechanical properties through cross-linking, ablation rates can also be manipulated. Our hybrid hydrogels have the highest tensile strength and elasticity, as well as the fastest ablation rates of all samples tested. Such properties contribute to enhanced suturability and post-implantation healing. In the future, corneal hydrogels may supplement human donor corneas with tissue-engineered alternatives.

## Cornea-Controversies in Refractive Surgery

Monday 17 June

Paper #166

### Distribution of Keratoconus Match Index and Keratoconus Match Probabilities in a Normal Refractive Surgery Population

Youjia Shen, Tahra AlMahmoud, Eser Adiguzel, Mark Cohen, Avi Wallerstein

**Purpose** To determine the normal distribution of Keratoconus Match Index (KMI) and Keratoconus Match Probabilities (KMP) scores in a population of patients presenting for laser vision correction (LVC).

**Study Design** Restrospective review

**Methods** All patients presenting for LVC had ocular biomechanical properties measured by the Ocular Response Analyzer (ORA). Virgin eyes with reliable waveform scores ( $>6.5$ ) were examined with ORA software version 3.01, providing the new KMI and KMP indices. These were derived from analysis of waveforms from 5 clinical populations: normal, suspect keratoconus (KC), mild KC, moderate KC, and severe KC. KMI is a single numerical "keratoconus score" where decreasing values below 1 are more likely keratoconic waveforms. KMP is the percentage probability that an individual waveform matches the characteristics of the five clinical reference groups. Distribution and ranges were determined for KMI and KMP indices.

**Results** KMI and KMP scores for 8848 right eyes were analyzed. The average KMI was  $0.95 \pm 0.26$ , range of 0.12 to 2.08. KMP scores were distributed with 100, 96.4, 83.0, 5.6, and 0.01% matching characteristics of normal, suspect, mild, moderate, and severe KC populations. No waveform had more than 68% similarity to suspect, 65% to mild, 17% to moderate, and 1% to severe KC populations. 3.6% of eyes were 100% normal. 13.4% matched to both normal and suspect KC populations and have no more than 4% similarity to suspect KC and the lowest KMI was 1.18. Any waveforms with over 4% similarity to the suspect KC population also matched to 1 or more of the other KC populations as well and had KMI values less than 1.18. KMI was directly proportional to KMP in normal and indirectly proportionally to KMP in suspect, mild, and moderate KC ( $r=1.00, -0.997, -0.995, -0.397$ , respectively,  $p<0.001$ ).

**Conclusions** Only a small percentage of eyes presenting for LVC were found to match to moderate and severe KC populations. A large percentage of waveforms contain characteristics of both suspect and mild KC. It would be important to correlate these findings to topographies in order to determine the clinical utility of KMI and KMP scores.

## Cornea-Controversies in Refractive Surgery

Monday 17 June

Paper #167

Clinical Outcomes of Corneal Collagen Cross-linking Combined with Contact Lenses in Keratoconus

Andrew Boswall

**Purpose** To report the best-corrected vision in patients who have undergone corneal collagen crosslinking (CXL) followed by rigid gas permeable (RGP) lens fitting for keratoconus or post-LASIK ectasia. Outcomes at 3 months, 6 months, and 12 months are reported.

**Study Design** This is a retrospective chart review.

**Methods** Following institutional ethics board approval 50 consecutive patient charts between September 2009 and September 2012 were reviewed. Patients were excluded if no follow-up data was available. The following data was recorded: uncorrected and best-corrected visual acuity, contact lens parameters (base curve, diameter), and keratometry from corneal topography. The mean, range and standard deviations are reported.

**Results** The maximum keratometry before CXL was a mean of 64.0 D (range 46.9-96.6 D, SD 12.2). The uncorrected visual acuity before CXL was a mean 1.4 logMAR (SD 0.85, Snellen equivalent <6/120). The best-corrected visual acuity with spectacles or contact lenses before CXL was a mean of 0.52 logMAR (SD 0.49, Snellen equivalent 6/18).

At 3 months after CXL the mean maximum keratometry was 59.4 D (range 51.0-79.2 D, SD 10.4 D). The best-corrected visual acuity with RGP was a mean of 0.46 logMAR (SD 0.54, Snellen equivalent 6/18).

At 6 months: mean maximum keratometry was 58.7 D (range 50.1-78.9 D, SD 11.6 D); the best-corrected visual acuity with RGP was a mean of 0.2 logMAR (SD 0.1, Snellen equivalent 6/9).

At 12 months: the maximum mean keratometry was 59.3 D (range 46.6-69.1 D, SD 12.1 D); the best-corrected visual acuity with RGP was a mean of 0.2 logMAR (SD 0.2, Snellen equivalent 6/9).

**Conclusions** These results suggest that in moderate to severe keratoconus combined CXL and RGP lenses are an effective treatment for improving vision.

## Cornea-Controversies in Refractive Surgery

Monday 17 June

Paper #168

Angle kappa shift after topography-guided ablation and collagen cross-linking in keratoconus

Mazen Choulakian, Eser Adiguzel, Avi Wallerstein, Mark Cohen, Christopher S. Jackman

**Purpose** Previous work has shown an increasing displacement in the Line of Sight (LoS) with progressing keratoconus (KC). This study was to determine if there was a shift in Orbscan angle kappa in KC after treatment with topography-guided customized ablation treatment (TCAT) and corneal collagen cross-linking (CXL).

**Study Design** Restrospective review.

**Methods** Chart review of KC eyes treated with TCAT and CXL. Vertical and horizontal position of angle kappa recorded from Orbscan II topographies at pre-op and at 6M post-op. Pre-op and post-op variables collected for correlation. Paired t-tests were used to determine any significant shifts in angle kappa at specified time points post-op.

**Results** 48 KC OD eyes were examined, with an average horizontal and vertical pre-op angle kappa distance of  $-0.47 \pm 0.26$  and  $0.32 \pm 0.29$  um, respectively, with a total distance of  $0.59 \pm 0.29$  um from pupil center. There was a significant decrease in vertical angle kappa of  $-0.12 \pm 0.26$  um ( $p < 0.001$ ) while there was no significant change in horizontal angle kappa ( $p = 0.06$ ). There was also a significant decrease in total distance of  $-0.09 \pm 0.30$  um ( $p = 0.03$ ) from pupil center.

**Conclusions** Preliminary results indicate there is a significant decrease in the vertical axis of angle kappa in KC treated with TCAT and CXL. TCAT and CXL treatment result in flattening of the cone with a resultant shift in the line of sight towards the corneal vertex.

## Cornea-Controversies in Refractive Surgery

Monday 17 June

Paper #169

Evaluation on Topography-guided Photorefractive Keratectomy and Cross-linking for Ectasia After Laser-Assisted In Situ Keratomileusis

Simon P. Holland, David T.C. Lin, Johnson Tan, Gregory Moloney

**Purpose** To evaluate early results of topography-guided photorefractive keratectomy (TG-PRK) using 2 Laser platforms (Allegretto Wavelight laser and iVIS laser) with simultaneous collagen cross-linking (CXL) for ectasia after Laser-Assisted In Situ Keratomileusis (LASIK)

**Study Design** Retrospective, consecutive, interventional, non-comparative, non-randomized series

**Methods** Forty-one eyes with post-LASIK ectasia underwent TG-PRK treatment with simultaneous CXL. Trans-epithelial PRK and custom Topographical Neutralization Technique (TNT) were implemented. Treatments were adjusted to improve the refractive result leaving a residual stromal thickness of  $\geq 300\mu\text{m}$ . Cross-linking procedure follows the Dresden protocol. Twenty-nine eyes were treated using Allegretto Wavelight laser (AW) and 12 eyes with iVIS laser. Pre and post-operative assessment of symptoms, uncorrected visual acuity (UCVA), best spectacle corrected visual acuity (BSCVA), manifest refraction (MR), predictability and safety were assessed.

**Results** 18 of 29 eyes treated with the AW laser had sufficient data at 6 months for analysis: 13 of 18 eyes (72%) obtained UCVA of 20/40 or better, 8 eyes(44%) gained two or more lines of BSCVA while 1eye (6%) lost two or more lines of BSCVA; mean reduction in astigmatism (RIA) was 2.52D. 7 of 12 patients treated by the iVIS laser had sufficient data at 6 months for analysis: 4 of 7 eyes (57%) obtained UCVA of 20/40 or better, 2 eyes (29%) gained two or more lines of BSCVA while none lost two lines or more; mean RIA was 1.70D. All but 3 patients treated with either laser platform reported an improvement in symptoms.

**Conclusions** Early results demonstrate that custom TNT TG-PRK with CXL is a promising, effective and safe treatment for post-LASIK ectasia.

## Cornea-Controversies in Refractive Surgery

Monday 17 June

Paper #170

Refractive outcomes and safety of Topography-guided Photorefractive Keratectomy with simultaneous Cross-Linking for Keratoconus

David T.C. Lin, Simon P. Holland, Gregory Moloney, Johnson Tan

**Purpose** To evaluate the refractive outcomes and safety of simultaneous topography-guided photorefractive keratectomy (TG-PRK) with collagen cross-linking (CXL) for keratoconus (KC) using a custom Topographic Neutralization Technique (TNT), and to determine the degree of hyperopic effect of CXL-induced keratometric flattening one year after treatment.

**Study Design** Retrospective, consecutive, non-randomized, non-comparative case series.

**Methods** 207 eyes with contact lens intolerant KC underwent TG-PRK with Allegretto Wavelight (AW) laser using custom TNT with simultaneous CXL. Epithelium was removed by trans-epithelial laser. The amount of refractive correction was calculated with a minimum residual stromal depth of 300 microns and a target correction of -1.25 diopters (D). CXL was performed with riboflavin 0.1% application until aqueous staining, followed by UV irradiance of 370nm, 3mW/cm<sup>2</sup> (total up to 5.4 J/m<sup>2</sup>), for 8-15 minutes. Hypotonic riboflavin was used if the pre-treatment measured pachymetry was less than 400um. Bandage contact lens was put on after the treatment, followed by standard post PRK management. Symptom score (10 point), uncorrected visual acuity (UCVA), best spectacle corrected visual acuity (BSCVA), keratometry (K), and safety and complications were analyzed at 12 months after treatment.

**Results** 110 eyes completed 12 months of follow-up. 49 eyes (45%) achieved UCVA of 20/40 or better. 63 eyes (57%) had improvement in BSCVA, with 37 eyes (34%) gained 2 lines or more of BSCVA, and 7 eyes (6%) lost 2 lines or more of BCSVA. Average symptom score improved from 6.7 to 4.2 (rating from 0 to 10, 10 being most symptomatic). Mean astigmatism decreased from -2.82D preoperatively to -1.28D postoperatively. Mean postoperative refractive spherical equivalent (SE) regressed from -0.89D at 3 months post-operatively to -1.14D at 12 months, with 14 eyes (13%) having hyperopic progression. 4 eyes (4%) had hyperopic spherical equivalent of >1.50D. Complications included one case of herpetic keratitis, 5 eyes with delayed epithelial healing beyond 1 week, and another eye requiring penetrating keratoplasty for advanced haze and loss of 4 lines of BSCVA.

**Conclusions** Early satisfactory refractive outcomes and safety were obtained with simultaneous topography-guided PRK with CXL. Progressive hyperopia probably related to cross linking, sufficient to be visually significant, occurred in 4 eyes. At one year follow-up, almost half of the eyes achieved UCVA of 20/40 or better and slightly more than half of the cases had improvement in BSCVA.

## Cornea-Controversies in Refractive Surgery

Monday 17 June

Paper #171

Incidence and outcomes of intra-operative flap complications during LASIK procedures

Avi Wallerstein, Eric Maika, Jeb Ong, Eser Adiguzel, Mark Cohen

**Purpose** To determine the true incidence of intra-operative LASIK flap complications and report their outcomes.

**Study Design** Restrospective multi-centre review

**Methods** Multi-surgeon standardized high volume corporate practice chart review of all LASIK eyes from Jul. 2006-Apr. 2011. Incidences of intra-operative microkeratome complications during creation of the LASIK flap were recorded. Accuracy, efficacy, and safety outcomes were examined post-retreatment, if any. Contralateral eyes with no intra-operative flap complication and receiving a single LVC treatment were used as comparative control eyes, when available.

**Results** 535 intra-operative flap complications in 250,831 LASIK procedures, yielded an incidence of 0.21%. Flap complications consisted of 49.1% short flaps, 46.4% buttonhole/thin flaps, 3.1% decentered flaps, and 1.4% free caps. Surgeons with less than 1000 surgeries had an incidence of 0.59%, 1000-5000 surgeries 0.26%, and over 5,000 surgeries 0.14%.

Follow-up data was available in 220 eyes. No eyes lost more than 2 lines, 2.3% (4 eyes) lost 2, and 13.3% (23 eyes) lost 1 line of CDVA, post-complication before re-treatment.

135 eyes had re-treatment post-complication. Re-treatment occurred an average of  $4.09 \pm 3.78$  mths post-complication, with 65% PRK, 35% LASIK re-cut. Follow-up data post re-treatment was available at  $12.6 \pm 11.4$  mths (range from 3 to 50 mths). 49%, 76%, and 93% of eyes were within  $\pm 0.25$ ,  $\pm 0.50$ , and  $\pm 1.00$  of intended MRSE, respectively. In control eyes, 63%, 84%, and 97% of eyes were within  $\pm 0.25$ ,  $\pm 0.50$ , and  $\pm 1.00$  of intended MRSE, respectively. Cumulative UDVA of 20/20, 20/25, 20/30, and 20/40 or better in 62%, 82%, 89, and 98% of post-complication retreated eyes, with initial pre-op CDVA of 93%, 99%, 100%, and 100%, respectively. In control eyes, cumulative UDVA of 20/20, 20/25, 20/30, and 20/40 or better in 65%, 89%, 94, and 99% of post-complication retreated eyes, with initial pre-op CDVA of 97%, 99%, 99%, and 100%, respectively. Efficacy index was 0.88 compared to 0.91 in contralateral eyes ( $p=0.2$ ). No eyes lost more than 2 lines of CDVA, 1.2% (1 eye) lost 2 lines, 4.9% (4 eyes) lost 1 line, and 4.9% (4 eyes) gained 1 line, while in control eyes, 6.6% (5 eyes) lost 1 line with no eyes losing more and 2.6% (2 eyes) gained 1 line. Safety index was 1.00 compared to 0.99 in contralateral eyes ( $p=0.7$ ).

**Conclusions** In this high volume standardized corporate practice, flap complications occurred 1 in 2000. Increased surgeon experience lowered flap complication rate significantly. Retreatment of flap complications gives satisfactory outcomes but lower accuracy, but similar efficacy and safety compared to non-complication single treatment eyes.

## Cornea-Controversies in Refractive Surgery

Monday 17 June

Paper #172

Myopic laser vision correction outcomes in flat post-operative keratometry below 37D

Jella A. An, Eser Adiguzel, Mark Cohen, Avi Wallerstein

**Purpose** To determine the efficacy, accuracy, safety, stability, and satisfaction of laser vision correction (LVC) in myopes with postop keratometry less than 37D.

**Study Design** Retrospective, single-centre review

**Methods** All myopes undergoing LVC with postop keratometry (K) of less than 37 D in a single year were included. Post-op manifest refractive spherical equivalent (MRSE), cylinder, uncorrected distance visual acuity (UDVA), corrected distance visual acuity (CDVA), maximum K (Kmax), and minimum K (Kmin) were compared to pre-op. Outcomes measures were accuracy, efficacy, safety, and stability. Zywave aberrometry was performed and a standardized subjective quality of vision (QoV) questionnaire was administered 6 months postoperatively. Repeated-measures ANOVA and Holms Sidak post-hoc tests were used.

**Results** 108 eyes (65 patients) were identified with post-op keratometry of less than 37D (incidence: 1.5%). Attempted MRSE correction was  $-8.48 \pm 1.51$  D (range: -5.13 to -11.63 D). Preop Kmax was  $43.0 \pm 1.3$  D (range: 41 to 46 D) and Kmin was  $41.8 \pm 1.4$  D (range: 39 to 45 D). Postop Kmax was  $36.2 \pm 0.7$  D (range: 33.6 to 36.9 D) and Kmin was  $35.6 \pm 0.7$  D (range: 33.0 to 36.8 D). 59%, 76%, and 96% of eyes were within  $\pm 0.25$ ,  $\pm 0.50$ , and  $\pm 1.00$  D of target postop refraction ( $R^2 = 0.914$ ). Cumulative UDVA was 20/20, 20/25, 20/30, and 20/40 or better in 71, 85, 95, and 99% of eyes, respectively, compared to preop cumulative CDVA of 81, 94, 99, and 100%, respectively. Efficacy index was 0.98. Only loss of Snellen lines of CDVA was in 1 eye with 1 line loss, while 14% gained 1 and 2.6% gained 2 or more lines. Safety index was 1.04. Post-op MRSE was stable at 1, 3, 6 months or later time points ( $p=1.00$ ). There were no significant correlations between post-op coma, spherical aberration, or total higher-order aberrations (HOAs) with post-op Kmax ( $r=-0.15$ ,  $p=0.43$ ;  $r=-0.19$ ,  $p=0.34$ ; and  $r=-0.26$ ,  $p=0.21$ , respectively), or Kmin ( $r=-0.20$ ,  $p=0.31$ ;  $r=-0.11$ ,  $p=0.58$ ; and  $r=-0.27$ ,  $p=0.19$ , respectively). Patients rated their post-op uncorrected QoV significantly higher than pre-op corrected QoV on a scale of 1 to 10 ( $8.9 \pm 1.3$  vs.  $7.8 \pm 1.8$ , respectively,  $p=0.01$ ). 94% of patients rated their overall QoV as improved compared to pre-op (65.6% significantly, 12.5% moderately, 15.6% slightly improved, and 6% unchanged).

**Conclusions** LVC in moderate to high myopia with resultant post-op K values between 33 and 37 D has outcomes comparable to those in the literature for eyes without flat Ks. Postop subjective QoV was excellent. Predicted flat keratometry post-op should not be a pre-op criterion of exclusion for LVC.

## Cornea-Controversies in Refractive Surgery

Monday 17 June

Paper #173

Characteristics and Treatment of post LASIK keratoectasia

Noa Avni-Zauberman, David Rootman

**Purpose** To identify the characteristics, and review the treatment options of patients with post LASIK keratoectasia treated in one center, between the years 2006-2012

**Study Design** Retrospective, consecutive case series

**Methods** 54 eyes of 34 patients with postLASIK ectasia were included (33 patients were referred for treatment). Uncorrected visual acuity, best spectacle corrected visual acuity, refraction (manifest and cycloplegic), keratometry, pachymetry and corneal aberrations were documented for each patient. Ectasia was diagnosed by slit lamp and topographic appearance of corneal thinning, topographic steepening, corneal thinning by ultrasonic pachymetry, decreased visual acuity, and unstable refraction. Treatment options included collagen cross-linking, combined cross-linking and corneal ring segments, corneal ring segments alone or corneal transplantation (DALK/PK). The treatment was based on the severity of findings

**Results** 32% women and 68% men. The mean age was 40 years (range 24-62 years). Ectasia developed less than 2 years, between 2-10 years and more than 10 years after LASIK in 26%, 50% and 6% of patients respectively; 18% missing data. 20.5% were OD, 20.5% OS and 59% were bilateral cases. 8 patients (12 eyes) had collagen cross-linking, one patient (1 eye) had intracorneal ring segments, 9 patients (11 eyes) had combined CXL and corneal ring segments, 3 patients (3 eyes) had keratoplasty (PKP or DALK). 6 patients are waiting for corneal transplant or combined CXL and ring segments.

**Conclusions** Post LASIK ectasia is a serious complication of refractive surgery. We found it to be more common in men, asymmetric bilateral with most cases developing between 2-10 years after surgery. The majority of patients may be treated with lesser invasive procedures such as collagen cross linking and corneal ring segments

## Cornea-Controversies in Refractive Surgery

Monday 17 June

Paper #174

High myopia outcomes with latest generation excimer laser.

Ananda Kalevar, Mounir Bashour, Eser Adiguzel, Mark Cohen, Avi Wallerstein

**Purpose** To determine the accuracy, efficacy, safety, and stability of laser vision correction (LVC) in high myopia greater than -10 D with a newer generation excimer laser.

**Study Design** Prospectively cohort study

**Methods** Contact lens-intolerant myopes with greater than -10 D manifest refractive spherical equivalent (MRSE) were included in the cohort. All eyes underwent aspheric PRK or LASIK targeting emmetropia, with a 400-Hz excimer laser. All performed by a single surgeon.

**Outcomes** measures were accuracy, efficacy, safety, and stability. A subjective quality of vision (QoV) questionnaire was administered to assess subjective patient satisfaction. RM-ANOVA and Holms Sidak post hoc tests were used for all statistical analyses.

**Results** 37 eyes (21 patients) were included, with pre-op average MRSE of  $-11.36 \pm 1.09$  D (range: -10.13 to -14.63 D); 31 eyes had postop data of 6 months or greater. Mean follow-up time was  $14.2 \pm 6.9$  months. 39%, 56%, and 87% of eyes were within  $\pm 0.25$ ,  $\pm 0.50$ , and  $\pm 1.00$  D of emmetropia ( $R^2 = 0.777$ ). Cumulative UDVA of 20/20, 20/25, and 20/40 or better in 45%, 71%, and 84% of eyes, respectively, compared to preop cumulative CDVA of 65%, 89%, and 100%, respectively. Efficacy index was 0.89. 1 eye lost 1 line of Snellen CDVA. No eyes lost more than 1 line while 23% gained 1 and 3% gained 2 lines. Safety index was 1.07. Postop MRSE was stable at 1, 3, 6 months, or later timepoints ( $p=0.38$ ). Patients rated their post-op uncorrected QoV significantly higher than pre-op corrected QoV on a scale of 1-10, average rating of  $9.0 \pm 0.8$  vs.  $7.4 \pm 1.2$ , respectively,  $p < 0.001$ . 100% of patients rated their overall QoV as improved compared to pre-op, 83% significantly improved 17% moderately improved.

**Conclusions** This cohort of eyes with greater than -10 D MRSE of myopia had better accuracy, efficacy, safety, stability, and satisfaction profiles than those published in high myopia with previous excimer laser technology. The safety profile was equivalent to that in low to moderate myopia, with excellent subjective satisfaction. Candidacy criteria for LVC should include contact lens intolerant high myopes between -10 to -14D.

## Cornea-Controversies in Refractive Surgery

Monday 17 June

Paper #175

Topography-guided Photorefractive Keratectomy (TG PRK) for Irregular Astigmatism following Penetrating Keratoplasty (PK)

Simon P. Holland, David T.C. Lin, Johnson Tan, Gregory Moloney

**Purpose** To evaluate the efficacy and safety of custom Topographic Neutralization Technique (TNT) in Topography-guided Photorefractive Keratectomy (TG PRK) for irregular astigmatism following penetrating keratoplasty (PK).

**Study Design** Retrospective, consecutive, non-comparative, non-randomized, interventional case series.

**Methods** Forty-seven eyes with post keratoplasty irregular astigmatism underwent TG PRK with Allegretto Wavelight (AW) laser using a custom Topographic Neutralization Technique (TNT) to modify the manifest refraction based on the refractive changes predicted from the plano TG treatment. Mitomycin-C 0.02% was applied in all cases immediately after treatment, followed by standard post-PRK management. Uncorrected visual acuity (UCVA), best spectacle corrected visual acuity (BSCVA), refraction, keratometry (K), topography and haze on a 1-4 scale were evaluated at 1, 3 and 6 months after treatment.

**Results** Twenty-eight eyes completed 6 months of follow-up. 13 of 28 eyes (46%) had UCVA of 20/40 or better while the best UCVA in the cohort prior to treatment was 20/50. 12 eyes (43%) had improvement in BSCVA, with 7 eyes (25%) gained 2 lines or more of BSCVA, while 3 eyes (11%) lost 2 lines or more of BSCVA. Pre-operative cylinder ranged from -0.75D to -13.50D, and post-operative cylinder ranged from 0 to -4.50D. Mean astigmatic reduction was 2.90D. Delayed epithelialization beyond one week was seen in 4 eyes, and corneal haze of greater than 2/4 was observed in 3 eyes. Retreatment for residual astigmatism was performed in 2 eyes.

**Conclusions** Topographically-guided PRK for irregular astigmatism after penetrating keratoplasty using topographic neutralization technique offers promising early results with good efficacy and safety. Almost half of the subjects achieved 20/40 or better UCVA compared to none pre-operatively, and 43% of eyes had improvement in BSCVA.

## Cornea-Controversies in Refractive Surgery

Monday 17 June

Paper #176

Taco flaps: a new classification of a post-operative LASIK flap complication

Avi Wallerstein, Elie Bechara, Eser Adiguzel, Mark Cohen

**Purpose** To describe and examine the incidence and risk factors of a specific type of post-op LASIK flap complication previously unreported in the literature.

**Study Design** Restrospective multi-centre review

**Methods** Multi-surgeon high volume corporate practice with chart reviews of all LASIK procedures within the past 6 months, to examine the incidence of a single, full-thickness flap fold complication post-LASIK with unknown etiology unrelated to trauma. All eyes underwent LASIK with Hansatome microkeratome, with standardized technique. Pre-operative, intra-operative, and time of complication data were collected for analysis of possible risk factors. Accuracy, efficacy, and safety outcomes of eyes were analyzed and compared to contralateral LASIK-operated eyes without complication.

**Results** A single, full-thickness flap fold complication post-LASIK, where the inferior flap flipped inwards onto itself, was named a taco flap. There were 47 taco flap complications (in 45 pts) in 32,965 LASIK procedures, for an incidence of 0.14%. Taco flaps occurred in 13% OD, 83% OS, 4%OU, on average  $0.6 \pm 0.6$  days post-LASIK (range 0-2 days).

Average pre-op MRSE was  $-4.08 \pm 2.54$  D, (range -9.50 to +2.25 D). One month after taco flap complication, 61, 84, and 97% of eyes were within  $\pm 0.25$ ,  $\pm 0.50$ , and  $\pm 1.00$ D of intended refraction, respectively, compared to 79, 86, and 93% of contralateral eyes, respectively. 55, 85, 91, and 97% of eyes had a cumulative post-op UDVA of 20/20, 20/25, 20/30, and 20/40, respectively, compared to pre-op CDVA in 83, 98, 100, and 100%. Cumulative post-op UDVA of 20/20, 20/25, 20/30, and 20/40 or in 77, 90, 93, and 97% of contralateral eyes compared to pre-op CDVA in 91, 98, 100, and 100%. Efficacy index was 0.9 compared to 1.0 in contralateral eyes ( $p=0.2$ ). No eyes lost 2 or more lines of Snellen CDVA, 16% lost 1 line, and 71% no change, compared to contralateral eyes with no loss of 2 or more lines, 4% lost 1 line, no change in 85%. Safety index was 1.0 compared to 1.0 in contralateral eyes ( $p=0.5$ ).

19% of taco flaps had a co-occurring complication, consisting of 10% DLK, 40% debris under flap, 50% epithelial ingrowth. All taco flaps were relifted, irrigated, and re-floated. No eyes needed a second relift procedure. Taco flaps occurred almost twice as often with less-experienced surgeons (<1000 surgeries, 0.28% incidence), than intermediate (1000-5000 surgeries, 0.15% incidence) and more-experienced surgeons (>5000 surgeries, 0.15% incidence).

**Conclusions** Taco flaps are described as a new subtype of post-LASIK flap complication,

occurring rarely and consisting of a full-thickness single flap fold resembling a taco, which distinguishes them from microstriae, macrostriae, and displaced flaps. Relift, irrigation, and refloating of the flap resulted in good outcomes that were less than contralateral non-taco eyes. This newly-described flap complication may affect visual outcomes.

## Glaucoma: Free Papers

Monday 17 June

### Paper #177

One year outcomes of a Schlemm's canal microstent for IOP reduction after cataract surgery in mild to moderate open angle glaucoma

Hady Saheb, Iqbal Ike K. Ahmed

**Purpose** To evaluate the 12 month intraocular pressure (IOP) reduction in patients with mild to moderate open angle glaucoma (OAG) following the implantation of an ab interno intracanalicular scaffold (Hydrus™ Aqueous Implant, Irvine, CA) in combination with cataract surgery.

**Study Design** This is a single center pilot study.

**Methods** Patients with mild to moderate OAG (based on Hodapp-Anderson-Parrish classification) and concurrent cataract were washed out of all hypotensive medications prior to surgery. The study device was placed into Schlemm's canal via an ab interno approach following phacoemulsification and intraocular lens placement. Follow up was conducted at 1 day, 7 days, and 1, 3, 6 and 12 months postoperatively. Study eyes were evaluated at follow up for IOP, medication use, and changes in visual status

**Results** 29 eyes from 27 patients were recruited into the study. The Schlemm's microstent was successfully implanted in 29/29 attempts. Mean ( $\pm$ sd) age was  $73.9 \pm 9.5$ ; average Humphrey MD was  $-6.9 \pm 4.2$  dB. Baseline mean IOP was  $17.9 \pm 4.1$  mmHg on an average of  $2.4 \pm 1.0$  glaucoma medications, and washed-out IOP was  $29.9 \pm 5.8$  mmHg on the day of surgery. Postoperatively, adverse events included 1 subconjunctival hemorrhage, 1 hyphema, and 2 peripheral anterior synechiae. At 1, 3, 6 and 12 months follow up, IOP (N) was  $17.2 \pm 3.4$  (27),  $15.8 \pm 3.3$  (27),  $15.3 \pm 2.3$  (26), and  $16.5 \pm 2.9$  (24) mmHg on a mean of  $0.5 \pm 1.0$ ,  $0.2 \pm 0.6$ ,  $0.1 \pm 0.4$ , and  $0.6 \pm 1.1$  glaucoma medications, respectively. At 12 months follow up, 19/24 (79%) patients completing follow up were medication-free.

**Conclusions** An intracanalicular scaffold was safely and successfully implanted after cataract surgery in 29/29 mild to moderate OAG eyes. At 12 months follow up, IOP and medication use were reduced.

Glaucoma: Free Papers

Monday 17 June

Paper #178

Prospective Randomized Study Comparing ExPRESS to Trabeculectomy: 1 Year Results

Yvonne M. Buys, Lilach Drori Wagschal, Yaping Jin, Delan Jinapriya, Graham E. Trope

**Purpose** The ExPRESS device was introduced as an alternative to trabeculectomy with anticipated advantages of improved safety and consistency given the standardized lumen size and less tissue manipulation. Of 5 retrospective and 2 prospective studies, one reported better success with ExPRESS and one lower IOP with trabeculectomy. In addition 2 studies reported lower rates of early hypotony and 1 less choroidals following ExPRESS. We designed a prospective RCT to compare the efficacy and safety of the ExPRESS shunt to standard trabeculectomy.

**Study Design** Prospective randomized controlled study.

**Methods** This study was approved by the UHN REB, followed the declaration of Helsinki and was registered as a clinical trial with the NIH (#NCT01263561). Consenting patients with open-angle glaucoma scheduled for filtration surgery were prospectively randomized to trabeculectomy or ExPRESS both with MMC. Exclusion criteria included any previous ocular incisional surgery with the exception of clear cornea phaco or one previous trab, uveitis and vitreous in the anterior chamber. The main outcome was IOP. Secondary outcomes included visual acuity (VA), number of glaucoma medications, complications, corneal pachymetry (CCT), endothelial cell counts (ECC), bleb morphology and additional procedures. Standardized data collection sheets were completed at baseline and day 1, weeks 1 & 2 and months 1, 2, 3, 6 and 12 post-op. A sample size calculation determined that 52 eyes were required to detect a 2 mmHg difference with a power of 80%.

**Results** 61 of 64 enrolled patients completed 1-yr F/U (31 ExPRESS and 30 Trab). There were no differences in baseline characteristics. The mean baseline IOP decreased from  $22.6 \pm 10.2$  and  $22.0 \pm 6.8$  to  $11.0 \pm 5.5$  and  $10.0 \pm 4.5$  at 1-yr in the ExPRESS and Trab groups respectively ( $p < 0.0001$ ). There was no significant difference in IOP between ExPRESS and Trab groups at any time point. Complete success (IOP 5-18 and 20% reduction from baseline without medication) was obtained in 71% ExPRESS and 57% Trab ( $p = 0.24$ ) and qualified success ( $\pm$  meds) in 87% ExPRESS and 93% Trab ( $p = 0.67$ ). 8 (26%) of the ExPRESS and 10 (33%) of the Trab patients were using glaucoma medications at 1-yr ( $p = 0.58$ ). Of the secondary outcomes the only significant difference was visual recovery which was faster in the ExPRESS group.

**Conclusions** At 1-year we found no statistically significant difference between ExPRESS and Trab groups regarding IOP, success rates, number of glaucoma medications, final VA, CCT, ECC, bleb morphology, complications and additional procedures. However, postoperative VA recovery was faster in the ExPRESS group.

## Glaucoma: Free Papers

Monday 17 June

Paper #179

Comparison of Combined Cataract Surgery with iStent versus Trabectome

Michelle Khan, Hady Saheb, Arvind Neelakantan, Iqbal Ike K. Ahmed

**Purpose** To evaluate and compare the intraocular pressure and medication reduction of iStent versus trabectome when combined with cataract surgery in patients with open angle glaucoma.

**Study Design** Retrospective interventional comparative case series.

**Methods** 29 patients that underwent combined cataract surgery and two iStent implantation and 22 patients that underwent combined cataract and trabectome surgery with 12 month follow-up were included in this study. Efficacy measures were intraocular pressure (IOP) and topical ocular hypotensive medication use.

**Results** Baseline IOP and number of glaucoma medications decreased from 18.0 +/- 4.7 to 14.9 +/- 3.5 mmHg ( $p < 0.001$ ) and from 2.8 +/- 1.0 to 1.1 +/- 1.3 mmHg ( $p < 0.001$ ) at 12 months in the combined cataract surgery and two iStent group. In the combined cataract and trabectome surgery group, IOP and glaucoma medications decreased from 19.4 +/- 5.3 to 14.9 +/- 5.8 mmHg ( $p = 0.009$ ) and 2.7 +/- 1.0 to 2.2 +/- 1.4 ( $p = 0.14$ ). There were no differences between the groups for preoperative IOP ( $p = 0.3$ ), preoperative medication use ( $p = 0.5$ ), and postoperative IOP at 12 months ( $p = 0.9$ ). Postoperative 12-month medication use was greater in the trabectome group vs iStent group ( $p = 0.004$ ). 41% of patients in iStent group and 5% in trabectome group had an IOP  $< 18$  on no medications at 12 months ( $p = 0.001$ ).

**Conclusions** Both iStent and trabectome are now being using as micro-invasive glaucoma surgery options for patients with open angle glaucoma. This study shows a significant and comparable reduction of intraocular pressure over a 12-month period for the two procedures when combined with cataract surgery. Combined cataract surgery with iStent resulted in less postoperative medication use than combined trabectome surgery.

## Glaucoma: Free Papers

Monday 17 June

### Paper #180

#### Projected Cost Comparison of Trabectome, iStent and Endoscopic Cyclophotocoagulation Versus Glaucoma Medication in The Ontario Health Insurance Plan

Yiannis Iordanous, Jerrod S. Kent, Cindy M. Hutnik, Monali Malvankar-Mehta

**Purpose** To compare the direct cost of treating glaucoma patients with Trabectome, iStent and endoscopic cyclophotocoagulation (ECP) versus topical medications in Ontario, Canada. Costs are projected over a 6-year period, and presented on a per-patient level from the perspective of the Ontario Health Insurance Plan (OHIP).

**Study Design** Cost analysis study.

**Methods** The per-bottle cost of each medication was obtained from the 2011 Ontario Drug Benefit (ODB) formulary. A wastage adjustment fee was added to the cost, as was a pharmacy markup, and an ODB dispensing fee. Previously published medication prescription rates were used to determine the frequency with which each medication is prescribed. We estimated the overall cost by taking a weighted average of the cost of each class of glaucoma medications. The cost of each glaucoma device was determined by contacting local distributors. We then added the cost of disposables used during surgery (viscoelastic and keratome) to the cost of each procedure. Start-up costs for each device and surgeons' fees were excluded from the overall cost.

**Results** At 6 years, treatment with the Trabectome offered a cumulative cost savings of \$242.68, \$1507.83 and \$2320.91 per patient versus mono-, bi-, and tri-drug therapy respectively. A cumulative cost difference of -\$57.31, \$1207.83 and \$2020.91 per patient were found when comparing iStent versus mono-, bi-, and tri-drug therapy respectively. Treatment with ECP yielded a cost savings of \$742.68, \$2007.83 and \$2820.91 per patient versus mono-, bi-, and tri-drug therapy respectively.

**Conclusions** Over a projected period of 6 years, the Trabectome, iStent and ECP may all offer a modest cost savings to OHIP versus the cost of glaucoma medication. Further analysis of direct and indirect costs to patients as well as quality of life assessments will help further delineate the role of these treatments in the glaucoma treatment paradigm.

## Glaucoma: Free Papers

Monday 17 June

### Paper #181

Improving access and cycle time through a hospital based teleglaucoma program

Karim F. Damji, Sourabh Arora, Chris J. Rudnisky

**Purpose** To compare access time and cycle time between a hospital-based teleglaucoma program and traditional in-person glaucoma consultation.

**Study Design** Prospective comparative study

**Methods** There were 71 patients seen through the teleglaucoma program and 63 seen via traditional exam with a physician present. Access time was the number of days elapsed from when the patient was referred, until the date of their booked visit for either a teleglaucoma or traditional in-person exam. Third next appointment time was also used to measure access to health services; it was calculated over a series of days to determine the third next available appointment for a consultation for each study group. Cycle time was defined as the time from registration until departure, within the hospital. It was calculated for the subset of patients who completed activity logs on the day of their appointments.

**Results** The mean access time was significantly shorter for patients seen through teleglaucoma as compared to in-person exam:  $45 \pm 22$ ,  $n=68$ , range 13 - 121 days vs.  $88 \pm 47$ ,  $n=63$ , range 27-214 days;  $p<0.0001$ . The third next available appointment time for patients seen through teleglaucoma was also significantly shorter than for patients assessed by the physician in person:  $53 \pm 12$  days,  $n=26$  vs.  $192 \pm 41$  days,  $n=36$ ;  $p<0.0001$ . The cycle time was reduced for patients undergoing diagnostic testing through teleglaucoma, as compared to a traditional assessment:  $78 \pm 20$ ,  $n=39$ , range 40 - 130 minutes vs.  $115 \pm 44$ ,  $n=39$ , range 51-216 minutes;  $p<0.001$ . The mean percentage time spent in waiting room was also significantly reduced for patients seen through teleglaucoma vs. in person assessments:  $19 \pm 13\%$  versus  $41 \pm 24\%$ ,  $n=39$ ,  $p<0.01$ .

**Conclusions** Teleglaucoma improves access to care and is a more efficient way of managing glaucoma suspects and patients with early stage glaucoma as compared to traditional in-person assessment. A separate study is underway to validate the teleglaucoma exam and compare it to an in person examination for the same patient.

## Glaucoma: Free Papers

Monday 17 June

### Paper #182

Association between glaucoma, glaucoma therapies, and erectile dysfunction

Nawaaz A. Nathoo, Mahyar Etminan, Frederick S. Mikelberg

**Purpose** To examine the association between 1) glaucoma and erectile dysfunction (ED), and 2) topical beta-blocker (BB) use and ED.

**Study Design** Pharmacoepidemiological nested case-control study.

**Methods** A comprehensive, province-wide database of physician visits and diagnoses, and prescription drug dispensing was used to identify cases of ED (1380) and find corresponding controls (13,800). A conditional logistic regression model was used to estimate rate ratios for two main exposures: 1) diagnosis of glaucoma and 2) use of a prescription of a topical BB prior to the index date. A variety of risk factors were adjusted for. Institutional review board approval at the University of British Columbia was prospectively obtained.

**Results** Cases were more likely to have coronary artery disease, chronic obstructive pulmonary disease, and diabetes. The crude rate ratio of a current diagnosis of ED in a population with at least 2 separate diagnoses of glaucoma was 1.34, and adjusted for a number of variables, this ratio was 1.37 (95% CI 1.06-1.76). Use of topical BB in the 30 days prior to the diagnosis of ED did not have a significant association with a diagnosis of ED, with crude and adjusted rate ratios of 1.05 and 1.10 (95% CI 0.61-1.99). Topical ocular prostaglandin use was also not associated with ED with crude and adjusted rate ratios of 0.96 and 0.93 (95% CI 0.57-1.53).

**Conclusions** Our results confirm an association between ED and glaucoma that cannot be attributed to topical BB use. Given that most cardiovascular and metabolic risk factors were adjusted for, further research in this area will be necessary to elucidate the nature of this association and potential causation.

## Glaucoma: Free Papers

Monday 17 June

### Paper #183

The influence of power settings for SLT and ALT in the treatment of open angle glaucomas: a systematic review and meta-analysis

Sourabh Arora, Karim F. Damji, Ezekiel Weis

**Purpose** To study the relationship between power settings for SLT and ALT in treating glaucoma

**Study Design** Meta-analysis

**Methods** A comprehensive literature search was performed using MEDLINE and Embase using the PRISMA guidelines. Prospective clinical studies published in English were eligible if they investigated SLT or ALT and reported mean IOP reduction at 6 or 12 months.

**Results** There were 13 eligible studies each for the analysis of SLT and ALT (1,328 cases). The mean power settings reported were 0.79 (0.2 - 1.7) mJ for SLT and 725 (400 - 1500) mW for ALT. Majority of studies reported treatment that was 180 degrees (18/29 study groups) or 360 degrees (8/29 study groups). The summary meta-analysis for all studies using a random effects model for both SLT and ALT revealed an IOP reduction at 6 months of 6.16 mm Hg (CI 4.83-7.49, 1,044 cases) and at 12 months of 5.89 mm Hg (CI 4.57-7.20, 1,122 cases). The meta-regression revealed no difference in ALT vs. SLT at 6 months ( $P=0.459$ ) and 12 months ( $P=0.262$ ). There was no evidence of publication bias. Meta-regression revealed an association between ALT's minimum power ( $P < 0.001$ ,  $P=0.046$ ), maximum power ( $P < 0.001$ ,  $P=0.046$ ), and number of spots ( $P < 0.001$ ,  $P=0.025$ ) at 6 and 12 months respectively. There was no association with bubbling/blanching level versus IOP at 12 ( $P=0.931$ ) months for ALT. SLT pressure reduction is significantly improved ( $P = 0.001$ ) at 12 months by 2.25 mmHg if used to a level of occasional or micro bubbling, as opposed to bubbling with every single spot. For SLT, there was no difference in 12 month IOP based on the minimum energy ( $P=0.127$ ), maximum energy ( $P=0.863$ ), number of spots ( $P=0.549$ ), or degrees treated ( $P=0.451$ ).

**Conclusions** Increases in the power settings, number of spots, and degrees treated using ALT resulted in larger IOP reduction at 6 and 12 months. There was no association of IOP reduction with the visual endpoint for treatment with ALT; however with SLT IOP reduction is significantly improved at 12 months if used to a point of occasional or micro bubbling vs bubbling with every single spot. SLT efficacy is not influenced by the range of power settings previously reported, or whether treatment is 180 versus 360 degrees.

## Glaucoma: Free Papers

Monday 17 June

### Paper #184

#### Prospective Randomized Clinical Trial on the Effects of Latanoprost, Travoprost and Bimatoprost on Latanoprost Non-Responders

Mohammad Hamid, Zineb Ghali, Pierre Blondeau

**Purpose** To determine whether a patient that is non-responder to latanoprost 0.005% after one month of use should either: continue using latanoprost 0.005% or switch to either brimatoprost 0.01% or travoprost 0.004%.

**Study Design** Prospective Randomized Clinical Trial

**Methods** 83 patients that had less than 20% of IOP reduction after 1 month of latanoprost treatment were randomly assigned for another month of treatment with either latanoprost, bimatoprost or travoprost. Recruited patients were diagnosed and examined by one treating glaucoma specialist with diagnosis of ocular hypertension, primary open angle glaucoma, normal tension glaucoma, pseudoexfoliation glaucoma and pigmentary glaucoma.

**Results** Overall 83 Caucasians patients were included in the study. 36 patients were males and 47 were females. Average age was 68.75 years. Average untreated IOP was 23.72 mmhg. Non-responder patients were randomized. 29 were in the latanoprost group, 31 in the bimatoprost group and 23 in the travoprost group. At randomization the average initial IOP were 21.69mmhg for the latanoprost group, 21.71mmhg for the bimatoprost group and 20.91mmhg for the travoprost group. After 1 month post randomization, 32 (38.5%) of the 83 patients became responders. Of those patients, 9 (31%) were on latanoprost, 13 (41.9%) on bimatoprost and 10 (43.5%) on travoprost. The difference between the response rate between the 3 groups was not statically different with a p value = 0.584.

The average IOP reductions were respectively -0.86mmgh, -2.10mmhg and -2.48. This difference is not statistically significant with a p value = 0.148.

**Conclusions** In patients that are initially non-responders to latanoprost, there is no added benefits of switching their medication to another topical prostaglandin. Regression towards the mean seems to be an important factor to explain our results and the ones of other similar switch studies.