
**Department of Ophthalmology and Vision Sciences
University of Toronto**

64th Annual Research Day
and
41st Clement McCulloch Lecture
and
Dr. Martin J. Steinbach Lecturer

Virtual Session I - April 26th 2022
Virtual Session II - May 3rd 2022
Virtual Session III - May 10th 2022

(7:00 – 9:00 PM)

Meeting Chairperson

Matthew Schlenker, MD, MSc, FRCSC
Assistant Professor
Department of Ophthalmology and Vision Sciences
University of Toronto

64th Annual Ophthalmology Research Day
and
41st Clement McCulloch Lecture
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Virtual Session III
April 26/ May 3/ May 10
(7:00 – 9:00 PM)

PROGRAM

7:00-7:03 PM Department Chair's Welcome
Dr. Sherif El-Defrawy

7:03-7:05 PM Annual Ophthalmology Research Day Chair Welcome
Dr. Matthew Schlenker

F= Fellow, R=Resident, M=Medical Student, G=Graduate Student, VS=VSRP (Vision Science Research Program) Student, RF= Research Fellow, U=Undergraduate Student

7:05 - 9:00 PM Session Panelist: Matthew Schlenker, Clara C. Chan, and Stephan Ong
Format: Tone
9 min. Presentation + 3 min. Discussion

7:05 – 7:14 PM	Early results of the novel 63µm ab interno gelatin microstent versus conventional 45µm microstent	Jessica Cao (RF)
7:17– 7:26 PM	The Cataract Surgery Learning Curve: Quantitatively Tracking a Resident's Operative Actions Throughout Their Training	Michael Balas (M)
7:29 – 7:38 PM	Corneal Hysteresis and Central Corneal Thickness: A Significant Association with SIBS Microshunt Surgical Outcomes	James Armstrong (RF)
7:41 – 7:50 PM	Prevalence and predictors for being unscreened for diabetic retinopathy: A population-based study over a decade	Poster Winner Tina Felfeli (R)
7:53 – 8:02 PM	Anemia and idiopathic intracranial hypertension: a retrospective observational and case-control study	Poster Winner Irina Sverdlichenko (M)
8:05 – 8:25 PM	<i>Dr. Martin J. Steinbach Lecturer</i> Diabetes and the Corneal Endothelium (Yes It Happens There Too)	Guest Speaker Dr. Mark A. Greiner
8:25 – 8:55 PM	Q & A and Discussion	
8:55 – 9:00 PM	Closing Session III	

ABSTRACTS FOR ORAL PRESENTATIONS

Virtual Session III

May 10th, 2022

Early results of the novel 63µm ab interno gelatin microstent versus conventional 45µm microstent

Jessica Cao^{1,2}, Iqbal (Ike) Ahmed^{2,3}

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²Temerty Faculty of Medicine, University of Toronto, Toronto, Ontario, Canada

³Prism Eye Institute, Mississauga, Ontario, Canada

Purpose: The 63µm ab interno gelatin microstent (Xen63) is a novel device with a larger lumen than the currently available 45µm microstent (Xen45). This study is amongst the first compare the impact of the Xen63 device on IOP and glaucoma medication use versus Xen45.

Study Design: Retrospective comparative cohort study.

Methods: Consecutive patients who underwent Xen63 implantation from February 2020 to June 2021 were compared with randomly selected patients who underwent Xen45 implantation. Standalone and combined cases with phacoemulsification were included. Success was defined as IOP ranges of 6-14 mmHg, 6-17 mmHg, or 6-21 mmHg plus 20% IOP reduction from baseline, starting at 1 month after surgery, without reoperations. Success without glaucoma medications (complete) and with medications (qualified) were tabulated. Data up to 6 months after surgery were analyzed.

Results: 42 eyes underwent Xen63 implantation, and 42 eyes underwent Xen45 implantation. The groups had similar baseline characteristics. Overall, mean age was 66.7 ± 14.0 years, 47 (55.9%) patients were female, and 38 (45.2%) patients had advanced disease. 12 Xen63 (28.6%) and 13 Xen45 (31.0%) cases were combined with phacoemulsification.

Preoperative IOP was similar between the two groups (Xen63: 25.9 ± 9.2 mmHg, Xen45: 26.0 ± 8.4 mmHg, $p=0.88$). At 6 months, mean IOP was significantly lower in Xen63 eyes (12.1 ± 4.2 mmHg vs. 15.6 ± 4.7 mmHg, $p<0.001$). Similarly, Xen63 eyes used significantly fewer medication classes at 6 months (0.4 ± 1.1 classes vs. 1.3 ± 1.4 classes, $p<0.001$), despite similar use at baseline (Xen63: 3.9 ± 1.1 classes, Xen45: 3.6 ± 1.0 classes, $p=0.26$).

6-month complete success was higher in the Xen63 group with IOP criteria of 6-14 mmHg (75.1% vs. 47.6%, $p=0.01$) as well as criteria 6-17 mmHg (75.6% vs. 50.0%, $p=0.043$). The crude hazard ratio of failure of Xen63 relative to Xen45 was 0.42 (0.21-0.83) and 0.50 (0.25-0.99) for criteria of 6-14 mmHg and 6-17 mmHg, respectively.

Needling occurred in 7 (16.7%) Xen63 eyes and 8 (19.0%) Xen45 eyes. Xen63 eyes had 5 (11.9%) reoperations, consisting of 3 Xen revisions and 2 Ahmed valve implantations. In the same period, the Xen45 group had 2 (4.8%) Xen revisions.

Conclusions: The novel Xen63 microstent resulted in significantly greater IOP lowering and medication reduction compared to Xen45 in the early postoperative course with good safety profile.

The Cataract Surgery Learning Curve: Quantitatively Tracking a Resident's Operative Actions Throughout Their Training

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⁶Prism Eye Institute, Mississauga, Ontario, Canada

Introduction: Cataract surgery is one of the most frequently performed surgical procedures in the world, and competence in this operation is therefore a public health necessity. Although some programs and evaluation rubrics have been developed, there are currently no validated metrics that quantitatively evaluate surgical performance in the operating room. Video recordings of cataract surgery are routinely captured, though such large datasets are of limited use on their own. The objective of this study was to annotate operative phases in cataract surgery videos and develop a data-driven approach to evaluating competence and skill progression over time.

Methods: We collected cataract surgery video recordings performed by a resident over their first year of surgical training between October 2021-2022. Only full-length videos of adequate quality without supervisor intervention were included. 18 distinct operative phases of cataract surgery were explored in this study, in addition to an idle phase representing periods of inactivity between other actions. A trained annotator manually labelled the start and end times of the phases in each video, which for most actions were determined by the entrance and exit of the instrument into the eye. Timeseries analysis was employed to measure the direction and magnitude of trends in the resident's surgical timing for each action across their first year of training.

Results: The final dataset comprised 100 recordings that were evenly spread throughout the resident's 6th and 760th cases. The average time for each case was 12.4min (IQR: 10.1min to 14.4min), with operative speed increasing at a rate of 43.4s for every 10 included videos (95% CI: 35.1s to 52.7s). 12 surgical phases demonstrated statistically significant downward trends in total timing across the resident's training using both the Mann-Kendall test and Theil-Sen estimator. The main incision (8.2%), phacoemulsification (7.8%), and hydrodissection (6.0%) phases had the greatest increases in speed throughout training relative to their average procedural time. Phases that did not exhibit a significant reduction in timing were those that are typically performed quickly and multiple times throughout each case such as hydrated wound closure or weck-cel drying.

Conclusion: This is the first study to quantitatively track a trainee's cataract surgical skill progression and elucidate the trends and learning curves seen across many operative actions. Future work will be directed towards the development of deep learning models that can automatically segment videos into their constituent surgical phases as well as incorporate other quantitative methods of assessment.

Corneal Hysteresis and Central Corneal Thickness: A Significant Association with SIBS Microshunt Surgical Outcomes

James J. Armstrong¹, Irfan Kherani¹, Matthew B. Schlenker¹ and Iqbal Ike Ahmed¹

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Purpose: Recent work has associated low corneal hysteresis (CH) with higher trabecular bypass surgery reoperation rates.(1) Post-operative wound healing impacts all glaucoma surgeries, and in particular bleb forming surgeries. Matrix and cell biology studies demonstrate that increased extracellular matrix stiffness is a major factor promoting scarring through direct myofibroblast activation.(2,3) CH may be considered a surrogate marker of ocular extracellular matrix biomechanical properties, as it can predict the compliance of posterior ocular tissues such as the optic nerve surface(4) and lamina cribrosa.(5,6) We hypothesize that lower CH is associated with stiffer ocular tissues and can identify patients with a propensity for dysregulated ocular wound healing, and by extension, increased failure rates of bleb-forming surgeries.

Study Design: Retrospective, interventional case series.

Methods: Consecutive patients with recent CH and central corneal thickness (CCT) measurements undergoing SIBS microshunt implantation between July 2015 and July 2020 were included. For comparisons, the cohort was divided into lower and upper 50th percentiles based on CH and/or CCT. Main outcome was proportion of eyes at 1-year with (1) no 2 consecutive IOPs >14 mmHg or clinical hypotony, without (complete) or with (qualified) glaucoma medications; and (2) ≥20% reduction from baseline IOP. Secondary outcomes included median IOP, medications, risk factors, post-operative interventions, complications, and reoperations.

Results: Fifty-one eyes of 50 patients were included. Low (<9mmHg) and high (≥9mmHg) CH cohorts only differed significantly in median [IQR] baseline medication use (4 [3-4] vs. 3 [1-4], respectively). After 12-months, patients with low CH achieved a 53.8% success rate and the high CH cohort achieved 76.0%. Patients with both low CH and low CCT (<533µm) achieved success in 43.8% of cases, whereas the remaining patients achieved an 85.7% success rate. The low CH cohort experienced a significantly higher risk of failure (HR 9.3; 95%CI 2-43). Further, for each 1 mmHg lower a patient's CH, a significantly increased risk of failure was observed (HR 1.6; 95%CI 1.1-2.2). Patients in the low CH cohort required significantly more post-operative medications (2.9 vs. 0.6; p<0.0001) and experienced significantly shorter medication-free survival time (5.8 v. 7.3 months; p<0.001). Needling rates were significantly higher in the low CH cohort (OR 4.3; 95%CI 1.1-16.2), as were reoperations (OR 4.1; 95%CI 2.1-8.1).

Conclusions: Our findings, while limited by sample size and their retrospective nature, strongly suggest that CH impacts subconjunctival glaucoma surgery outcomes. More work encompassing basic science and prospective clinical studies is required to fully explore this novel and potentially robust risk factor.

References:

1. Tracer N, Ayoub S, Radcliffe NM. The association between corneal hysteresis and surgical outcomes from trabecular meshwork microinvasive glaucoma surgery. *Graefes Arch Clin Exp Ophthalmol*. 2021;259(2):475–81.
2. Tomasek JJ, Gabbiani G, Hinz B, Chaponnier C, Brown RA. Myofibroblasts and mechano-regulation of connective tissue remodelling. *Nat Rev Mol Cell Biol* [Internet]. 2002;3(5):349–63. Available from: <http://www.nature.com/doi/10.1038/nrm809>
3. Shu DY, Lovicu FJ. Progress in Retinal and Eye Research Myofibroblast transdifferentiation: The dark force in ocular wound healing and fibrosis. *Prog Retin Eye Res* [Internet]. 2017; Available from: <http://dx.doi.org/10.1016/j.preteyeres.2017.08.001>
4. Wells AP, Garway-Heath DF, Poostchi A, Wong T, Chan KCY, Sachdev N. Corneal hysteresis but not corneal thickness correlates with optic nerve surface compliance in glaucoma patients. *Investig Ophthalmol Vis Sci*. 2008;49(8):3262–8.
5. Lanzagorta-Aresti A, Perez-Lopez M, Palacios-Pozo E, Davo-Cabrera J. Relationship between corneal hysteresis and lamina cribrosa displacement after medical reduction of intraocular pressure. *Br J Ophthalmol*. 2017;101(3):290–4.
6. Wong BJ, Moghimi S, Zangwill LM, Christopher M, Belghith A, Ekici E, et al. Relationship of Corneal Hysteresis and Anterior Lamina Cribrosa Displacement in Glaucoma. *Am J Ophthalmol* [Internet]. 2020;212:134–43. Available from: <https://doi.org/10.1016/j.ajo.2019.11.017>.

Prevalence and predictors for being unscreened for diabetic retinopathy: A population-based study over a decade

Tina Felfeli, MD;^{1,4} Lesley Plumptre, PhD;³ Glen Katsnelson, MSc;⁵ Alex Kiss, PhD;^{2,3,6} J. Michael Paterson, MSc;^{2,3} Brian G. Ballios, MD, PhD, FRCSC;^{1,7,8} Efreem D. Mandelcorn, MD, FRCSC;^{1,7} Richard H. Glazier, MD, MPH;^{2,3,9,10} Michael H. Brent, MD, FRCSC;^{1,7} David T. Wong, MD, FRCSC^{1,11}

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Purpose: While screening for diabetic retinopathy (DR) is essential for detecting preventable vision loss, several risk factors have been identified as barriers for adherence to screening. This study aimed to determine the population-level prevalence of individuals with diabetes screened and unscreened for DR in a developed country.

Study Design: Retrospective population-based repeated cross-sectional study.

Methods: This study used linked, health administrative data at ICES (formerly Institute for Clinical Evaluative Sciences), which houses data for all permanent residents in Ontario through the universal publicly funded healthcare services. All individuals with diabetes (type 1 and 2) aged ≥ 20 years in the Ontario population were identified in 2011-2013 and 2017-2019 time periods. The main outcome measures included the prevalence of DR screening amongst Ontarians over the study period and the predictors for being unscreened for DR based on sociodemographic factors. For comparison of proportions, chi-square and Mantel-Haenszel test were performed and reported along with the relative risk (RR) and associated 95% confidence intervals (CI).

Results: A total of 1,145,645 and 1,346,578 individuals with diabetes were identified in 2011-2013 and 2017-2019, respectively. The proportion of patients unscreened for DR declined very slightly from 35% (405,967) in 2011-2013 to 34% (455,027) in 2017-2019 of the population with diabetes (RR=0.967; 95% CI=0.964-0.9693; $p<0.0001$). Having more comorbidities was associated with higher screening rates; however, even amongst the highest healthcare users, 29% and 33% were unscreened at the two time-points, respectively. Young adults aged 20-39 years old had the highest proportion of unscreened patients (62% and 58% in 2011-2013 and 2017-2019, respectively). Additionally, those who had a lower income quintile (RR=1.039; 95% CI=1.036-1.044; $p<0.0001$), were recent immigrants (RR=1.286; 95% CI=1.280-1.293; $p<0.0001$), lived in urban areas (RR=1.149; 95% CI=1.145-1.154; $p<0.0001$), had a mental health history (RR=1.117; 95% CI=1.112-1.122; $p<0.0001$), or lacked a connection to a primary care provider (RR=1.656; 95% CI=1.644-1.668; $p<0.0001$) had a higher risk of being unscreened.

Conclusions: Although the proportion of unscreened individuals has remained relatively the same over the past decade, there has been an increase in the number of individuals unscreened for DR with the general population growth in Ontario, Canada. Amongst individuals with diabetes, young age, low-income status, immigration, residence in a large city, prior history of mental illness, and lack of access to primary care, are risk factors for being unscreened for DR. These findings will guide resource allocation aimed at improving the rates of DR screening for underserved populations.

Anemia and idiopathic intracranial hypertension: a retrospective observational and case-control study

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Introduction: The relationship between anemia and idiopathic intracranial hypertension (IIH) continues to be controversial. The goal of the present study was to: 1) Determine the relative prevalence of anemia in IIH patients compared to age and sex-matched controls attending neuro-ophthalmology clinics and 2) To compare the initial and final visual outcomes of IIH patients with and without anemia.

Methods: 123 consecutive IIH patients were recruited from tertiary neuro-ophthalmology clinics and matched by age and sex to 113 non-IIH neuro-ophthalmology controls. Retrospective chart review obtained information on demographics, symptoms and visual function at presentation and final follow-up. Complete blood counts (CBC) were collected within 6 months of diagnosis and 3 months of final follow-up and anemia diagnosis was made based on hemoglobin <120g/L for women and <130g/L for men. Anemia was further classified as mild (hemoglobin >110g/L), moderate (hemoglobin 80-109g/L), and severe (hemoglobin <80g/L). The study protocol was approved by the University of Toronto Research Ethics Board.

Results: More IIH patients than controls met criteria for anemia (22.8%, 28/123 versus 10.6%, 12/113, $p=0.01$), with an odds ratio of 2.48 (95% CI 1.19-5.16). IIH patients had a significantly lower mean hemoglobin than controls ($127.6\text{g/L} \pm 18.0$ versus $133.0\text{g/L} \pm 11.8$, $p<0.01$) and 17.9% (5/28) of anemic IIH patients had severe anemia compared to zero in the control group. When comparing the 28 IIH patients with anemia to the 95 IIH patients without anemia, there were no differences between groups in terms of sex, age, body mass index (BMI) or symptomatology. IIH patients with anemia were more likely to have mild-to-moderate visual acuity impairment (logMAR 0.3-1; 14.3%, 8/56 eyes versus 3.7%, 7/190 eyes, $p=0.01$) and worse Humphrey mean deviation ($-5.7\text{dB} \pm 8.1$ versus $-3.4\text{dB} \pm 4.2$, $p=0.048$) compared to non-anemia IIH patients at presentation. At final follow-up, there was no difference in visual acuity, but Humphrey mean deviation continued to be worse among anemic IIH patients ($-5.6\text{dB} \pm 6.4$ versus $3.2\text{dB} \pm 5.7$, $p=0.045$).

Conclusions: Anemia is more prevalent among IIH patients compared to neuro-ophthalmology controls and may influence the initial and final visual function in IIH patients. As a CBC is a widely available test, we suggest that it be obtained in all patients with new papilledema.

Guest Lecture

8:05 – 8:25 PM

Dr. Martin J. Steinbach Lecturer

Diabetes and the Corneal Endothelium (Yes It Happens There Too)

Dr. Mark Greiner MD



Dr. Mark A. Greiner is the Robert and Joell Brightfelt Professor of Cornea Research in the Department of Ophthalmology and Visual Science. He directs the Cornea, External Diseases and Refractive Surgery service and fellowship. He is also the Medical Director of the Iowa Lions Eye Bank, and has served in various leadership roles within eye banking including on the Eye Bank Association of America's Board of Directors. Additionally, he is a clinician-scientist with a translational research laboratory based at Iowa Lions Eye Bank that focuses on corneal endothelial cell metabolic function and keratoplasty outcomes. After earning his undergraduate degree in English with High Honors from the University of California at Berkeley, he received his medical degree and completed both internship and residency in Ophthalmology at the University of California at Davis. After completing fellowship training in Cornea and External Diseases at Devers Eye Institute in Portland, Oregon with Dr. Mark Terry and Michael Straiko, he joined the faculty at the University of Iowa in 2012. In addition to his longstanding interests in endothelial keratoplasty and resident medical education, Dr. Greiner has pursued his research interests in mitochondrial biology and cellular metabolism, Fuchs endothelial corneal dystrophy, and diabetes mellitus. Dr. Greiner is committed to improving the lives of patients with diseases of the cornea and is currently engaged in research investigating medical therapies for Fuchs dystrophy as well as the impact of diabetes on donor tissue health.

Learner objectives:

1. Describe the effects of diabetes on the corneal endothelium cornea
2. Understand the impact of diabetes on endothelial keratoplasty

Description of the program:

Diabetes mellitus is an important systemic disease that impacts all layers of the cornea, including the corneal endothelium and Descemet membrane. An overview of what we know – and still need to determine – about the impact of diabetes on the posterior cornea will be covered, with an emphasis on translational research and keratoplasty.