THE EIGHTEENTH ANNUAL
John T. Flynn Annual Resident/Fellow Research and Graduation Day
Edward S. Hakness Eye Institute
7th Floor Amphitheatre | Thursday, June 21, 2018 | 12:00 p.m. – 1:45 p.m.

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Name of Author(s): Carolina Adams, MD, Priya Mathews, MD, MPH, George Florakis, MD, Stephen Trokel, MD, Leejee Suh, MD.

Abstract Title: High Irradiance accelerated cross-linking refractive and topographic outcomes.

PURPOSE: To report 6-month outcomes of high irradiance accelerated cross-linking (CXL) in the treatment of patients with progressive keratoconus.

METHODS: Progressive keratoconus patients (23-52 years) received high irradiance accelerated crosslinking. Corneas were exposed to ultraviolet-A 365 nm light at 9.0mW/cm² for 10 minutes or 18mW/cm² for 5 minutes. Changes in uncorrected visual acuity, best spectacle-corrected visual acuity, K\textsubscript{max} and pachymetry were used to determine treatment efficacy. Data was collected preoperatively and postoperatively at 1 week, 1-month, 3-months and 6-months. Adverse side effects were collected.

RESULTS: Ten eyes (mean age 29.1 ± 8.55) underwent accelerated cross-linking. Uncorrected distance visual acuity remained stable from 0.49 ± 0.33 logMAR preoperative to 0.45 ± 0.33 logMAR at 6-months. Best spectacle-corrected visual acuity improved from 0.40 ± 0.12 logMAR preoperative to 0.33 ± 0.13 logMAR at 6-months. K\textsubscript{max} mean decreased from 60.48 ± 10.24 to 57.77 ± 7.24; preoperative and 6 months, respectively (P = 0.04).

DISCUSSION/CONCLUSIONS: The study demonstrates the ability of high irradiance accelerated crosslinking to halt the progression of keratoconus, as early as 6 months post-procedure.
Abstract Title: Therapeutic corneal tissue cross-linking (cTXL) using SMG eyedrops – a better way to cross-link the cornea?

PURPOSE:
Using an eyedrop, to develop a safe and effective way to increase corneal tissue strength where the effect can be modulated based on the patients’ response. This also avoids the use of UV light and painful epithelial debridement. For use as a replacement or adjunct to the current UV-riboflavin photochemical method (i.e. CXL)

METHODS:
Corneal therapeutic tissue cross-linking (cTXL) using sodium hydroxymethylglycinate (SMG) at 40 or 80mM was carried out on Dutch-belted rabbits (n=8) using 1.1% hydroxypropyl methylcellulose (HPMC) [viscosity <15 cP]. SMG eyedrops (right eye) and vehicle control (left eye) were applied to the corneal surface 1-3 times/day for up to 3 months. Intermittent bolus dosing (every 15 min for 1 or 3.5 hours followed by Draize testing) was also carried out on two animals. The animals were evaluated in real-time using ultrasound pachymetry, applanation tonometry, confocal microscopy (HRT3-RCM), corneal topography, and fluorescein epithelial staining. Post-mortem cross-linking effects were evaluated by mechanical inflation testing and thermal denaturation temperature, and routine histology was also included

RESULTS:
The higher 80mM concentration caused some irritation and drying of the eyelid during 3 months dosing. The 40mM eyes were normal. Corneal thickness, intraocular pressure, endothelial cell density, and epithelial defect changes were not significantly affected by either concentration tested over 3 months. Tissue stiffening by mechanical inflation testing was noted in 4 of 4 animals [avg Δapex displacement between treated and paired control eye (at 2kPa during creep testing) was: ΔDinitial=-0.0692mm±0.0266 and ΔDfinal=-0.0671mm±0.0196] and modest corneal thermal denaturation shifts (avg ΔTm=0.81±0.36) were noted in 3 of 3 samples. HRT stromal keratocyte changes included stellate and syncytial patterns of keratocyte activation as well as cell loss. These findings were noted only with 80mM, however, indicating that the treatment with 40mM was non-toxic while inducing cross-linking effects. There were no histologic abnormalities observed in the eyelid, lens or retina in the treated tissues

DISCUSSION/CONCLUSIONS:
Topical application of a 40mM (0.5%) SMG eyedrop is well tolerated by the living rabbit eye and can increase corneal tissue stiffness without damaging keratocytes. This is an important example of favorable toxicity/fixation balance.
Name of Author(s): Nikhil R Menon, MD, Jenelle Mallios, OD, Steven A Kane, MD, PhD, Steven E Brooks, MD

Abstract Title: Factors affecting IOP measurement with the I-care tonometer and Tonopen

PURPOSE: To determine the effect of corneal location, probe angle, corneal epithelium, and soft contact lens, on I-care tonometer and Tonopen measurements.

METHODS: Intraocular pressure (IOP) was controlled in 5 porcine eyes using a needle placed within the anterior chamber and connected to an adjustable-height water reservoir. IOP was measured at the central and paracentral cornea using each device over a range of controlled IOPs (5-40 mmHg). Central measurements were taken with I-care using probe angles of 0 and 15 degrees. IOP was also measured across a -1.00D or +1.00D soft hydrogel contact lens (CL), and after removal of the corneal epithelium.

RESULTS: Central versus paracentral measurements were not significantly different using either I-care (mean±SD 8.2±0.4 v. 8.6±0.8, p=0.39) or Tonopen (mean±SD 11.4±0.8 v. 11.2±0.4, p=0.66). I-care probe angle did not significantly affect measured IOP (mean±SD 6.0±0.0 v. 5.6±0.4, p=0.37), but instrument error resulted when the angle exceeded 15 degrees. A +1.00D soft CL caused a significant increase in I-care measurement (mean±SD 9.5±0.5 v. 6.5±0.5, p=0.02), but a -1.00D lens did not (mean±SD 6.0±0.0 v. 6.5±0.5, p=0.42). No significant differences were found with contact lenses using Tonopen. Corneal epithelium removal did not significantly affect measurements with either device.

CONCLUSIONS: In this experimental model, IOP measured with Tonopen or I-care was not significantly influenced by corneal location, removal of epithelium or, in the case of the I-care, by small deviations in probe angle, a particularly important feature in children and uncooperative adults. Measurements may be significantly affected by a plus-power soft CL.
Name of Author(s): De Rojas, J.O. & Zemsky, C.J., Horn, K.W., Florakis, G.J., & Suh, L.H.

Abstract Title: Refractive Outcomes After Cataract Surgery Combined with DMEK Versus Ultrathin DSAEK

PURPOSE:
DMEK is replacing DSAEK as the endothelial keratoplasty procedure of choice because of proven better post-op BCVA and UCVA. However, ultra-thin DSAEK (UT-DSAEK), defined as a donor graft < 100 microns thick, may be comparable to DMEK; this is yet to be evaluated in the United States. The purpose of this study was to describe BCVA and refractive outcomes of DMEK and UT-DSAEK.

METHODS:
A retrospective chart analysis was performed for endothelial keratoplasty procedures from 1/1/2010 through 1/6/2017 with concurrent cataract extraction/posterior chamber intraocular placement at our institution. Pre- and post-operative BCVA, spherical equivalent, difference between acquired and target refractions, hyperopic shifts, and any complications were compared between the 2 groups.

RESULTS:
A total of 30 patients who underwent cataract surgery combined with DMEK (n=16) or UT-DSAEK (n=14) were included in the analysis. Pre-op logMAR BCVA was the same between DMEK and UT-DSAEK (0.30 vs 0.36 respectively, P=0.36). At post-op month 6, no significant differences were found in logMAR BCVA (0.067 vs 0.068, P=0.97), spherical equivalent (-0.34 vs -0.27, P=0.83), or hyperopic shift (+0.24 vs +0.62, P=0.26). Our data suggest no difference in BCVA between groups and a trend towards more hyperopia after UT-DSAEK vs DMEK. Compared to the literature, we calculated less hyperopic shift after DMEK or UT-DSAEK, and even a myopic shift in a few patients.

DISCUSSION/CONCLUSIONS:
Our data suggest no difference in BCVA between groups and a trend towards more hyperopia after UT-DSAEK vs DMEK. Compared to the literature, we calculated a hyperopic shift after DMEK or UT-DSAEK, and even a myopic shift in a few patients.
Name of Author(s): Priya M. Mathews MD MPH, Joaquin O. De Rojas MD, Patrick Rapuano BA, Christine Zemsky BS, George J. Florakis MD, Stephen L. Trokel MD, Leejee H. Suh MD

Abstract Title: Correlation of Scheimpflug Densitometry Changes with Clinical Outcomes After Corneal Collagen Crosslinking

Setting: Tertiary referral academic medical center.

Design: Retrospective cohort study.

PURPOSE: To characterize changes in stromal haze, as measured by densitometry, after corneal crosslinking (CXL) and correlate with visual outcomes.

METHODS: Patients with progressive keratoconus or post-LASIK ectasia underwent CXL following the Dresden protocol. Best Spectacle-Corrected Visual Acuity (BSCVA) and tomographic metrics using Oculus Pentacam were obtained at baseline and follow-up visits. Corneal densitometry changes were analyzed in the anterior and mid-stromal layer.

RESULTS: Fifty-seven patients were followed for average of 15 months (range 1-24) after CXL. The BSCVA significantly improved from baseline at 6, 12, 18, and 24 months. The change in densitometry of the mid-stromal layer 2-6 mm annulus at 6 months was correlated with improvement in BSCVA at 6, 12, and 24 months (p<0.10 for all). The increase in densitometry of the mid-stromal layer, centermost 0-2 mm annulus, at 6 months was significantly associated with the decrease in Kmax at 6 and 12 months (p<0.05 for both). Lastly, the change in densitometry at 6 months was significantly correlated with decrease in certain higher order aberrations (HOAs)- total root mean-square, wave front aberration, and spherical aberration(p<0.05).

CONCLUSIONS: Although the greatest and most durable post-CXL densitometry change was in the anterior layer, the degree of increased densitometry haze in the mid-stromal layer was most associated with and possibly predictive of improvement in BSCVA, Kmax, and HOAs. We propose that the persistence of corneal haze at six months, as measured by increased densitometry, may be a prognostic marker for CXL effectiveness.
Name of Author(s): Sanghvi Menka, Skrzypecki J., Suh L.

Abstract Tittle: Refractive Predictions of Barrett Toric Calculator with and Without Posterior Corneal Astigmatism Measurements

BACKGROUND: Toric intraocular lens power calculators, eg. Barrett Toric Calculator, based on predicted, rather than on measured posterior corneal curvature have yielded the best refractive predictions. However, recent update of the Barrett Toric Calculator aims to fine-tune its refractive predictions with the input of measured posterior corneal curvature. We compared refractive predictions of Barrett Toric Calculator, based on IOL Master 700 biometry, with and without measurements of posterior corneal curvature to assess the accuracy of refractive predictions.

MATERIALS AND METHODS: Thirty eyes with Toric intraocular lens implantation with one surgeon were included in the study. One-month postoperative manifest refraction and predicted residual refractive error of both formulas were utilized to calculate mean absolute error and centroid error in predicted residual astigmatism. Pentacam was also used to measure posterior corneal curvature.

RESULTS: We did not find any statistically significant difference in mean absolute error and centroid error in predicted residual astigmatism between Barrett Toric Calculator with and without measurement of posterior corneal curvature. Post-hoc analysis for with-the-rule and against-the-rule astigmatic eyes did not reveal any significant difference as well.

CONCLUSIONS: Astigmatism prediction errors, based on IOL Master 700 biometry, with and without measured posterior corneal curvature, were similar in general group of patients. To the best of our knowledge, updated Barrett Toric Calculator is the first formula to provide non-inferior and reliable predictions based on measurement of posterior corneal curvature. Further studies are needed to show viability of this formula in eyes with skewed anterior to posterior curvature ratio eg. in keratoconus.
Abstract Title: Ultrasound Biomicroscopy Findings in Scleral Sutured Intraocular Lenses

PURPOSE: To describe the ultrasound biomicroscopy findings of patients who underwent surgery for a scleral sutured intraocular lens.

BACKGROUND: Placing an intraocular lens (IOL) in eyes without capsular support is a surgical challenge. The preferred surgical technique and lens type varies with surgical preference and experience. We report a case series of patients who presented with dislocated intraocular lenses or aphakia and who were managed with scleral sutured intraocular lenses. We report visual and refractive outcomes as well as ultrasound biomicroscopy (UBM) findings of scleral suturing IOLs.

METHODS: Retrospective observational case series of all patients undergoing sutured IOL placement with surgeon RL from June 2004 to April 2018 (n=43). We exclude eyes with concurrent corneal transplants or those lacking post-operative UBM findings. The remaining 10 eyes were then analyzed. Data was collected on IOL type, preoperative and postoperative K’s/axial length/refraction/best corrected visual acuity, and UBM findings that assessed centration and lens tilt. Centration was defined by the distance between the midpoint of scleral spurs and the midpoint of the IOL. Lens tilt was defined by the angle of the lens from a standardized line.

RESULTS: Patients’ mean age was 51.9 years old. 9/10 of patients required the sutured IOL because of a dislocated lens. 1/10 of patients required it because of aphakia. 7/10 eyes had axial myopia with an axial length of greater than 25 mm. 2/10 had been previously diagnosed with pseudoexfoliation syndrome. The CZ70BD lens was chosen for all eyes. The average lens power used was 16.6 diopters with a standard deviation of 4.1. Average preoperative K’s was 42.9 and average postoperative K’s was 43.4. Average preoperative corneal astigmatism was 1.8 diopters with a standard deviation of 1.5. Average postoperative corneal astigmatism was 2.2 diopters with a standard deviation of 1.6. The average spherical equivalent was -3.7 diopters with a standard deviation of 1.9. The average preoperative logmar was 0.4, which is equivalent to an average preoperative visual acuity of 20/50. The average postoperative was 0.2, which is equivalent to an average postoperative visual acuity of 20/32. UBM findings showed an average tilt of 2 degrees and average decentration 0.3 mm (SD 3.02 degrees and 0.2, respectively).

CONCLUSIONS: UBM findings for patients undergoing this procedure revealed well centered lenses with minimal tilt. The procedure did induce some corneal astigmatism (average 0.4 additional corneal astigmatism) which was less than expected. The patients were uniformly myopic which we attribute to the relatively anterior placement of the lens. We plan to adjust our lens power selection accordingly for future patients. Overall UBM findings, refractive outcomes, and visual acuity outcomes demonstrate that scleral sutured IOLs using a CZ70BD lens offers a valuable option to patient requiring lens placement without capsular support.
Name of Author(s): Stephen Walters MD, Chia-Kai Chu MD, Aakriti Garg MD, Dan Gong MD, Golnaz Moazami MD, Kalashree Gopal, Vipul Patel, Nicolas Jaccard PhD, C. Gustavo De Moraes MD, MPH, Sameer Trikha MD, Lama Al-Aswad MD, MPH.

Abstract Title: Investigation of a Deep Learning System in Identifying Glaucomatous Optic Neuropathy Based on Color Disc Photos

BACKGROUND: As technology advances, image acquisition and storage expands, and computer processing speeds improve, we are presented with a unique opportunity for the implementation of artificial intelligence (AI) in medicine to assist in both diagnosis and management of medical disease. With an abundance of clinical data and imaging, ophthalmology is a field that lends itself well to the implementation of AI. It has been shown to be useful in a variety disease within ophthalmology including diabetic retinopathy, retinopathy of prematurity, age related macular degeneration, and glaucoma.

PURPOSE: To evaluate the performance the AI Pegasus Deep Learning System (PDLS) in identifying glaucomatous optic neuropathy based on color disc photos

METHODS: Five ophthalmologists with different levels of training evaluated 110 publicly available fundus images from the Online Retinal Fundus Image Database for Glaucoma Analysis and Research (ORIGA). The reference standard was defined as agreement amongst 3 graders with the highest levels of agreement in a binary classification of glaucoma (probabilities >50%). The PDLS was compared with regards to sensitivity (se), accuracy (ac), positive predictive value (ppv), and negative predictive value (npv). The area under the curve (AUC-ROC) was calculated using the probability scale provided by the PDLS versus the reference standard using the Bootstrap technique with 1,000 replications.

RESULTS: The PDLS achieved AUC-ROC of 83% (95% CI=73-90%, P<0.05) se=96.1%, sp=58.3%, ac=67.2%, ppv=41.6%, and npv=98.0%.

CONCLUSION: The PDLS performed well in detecting glaucomatous optic neuropathy on disc photos when compared to expert graders. It achieved high sensitivity which suggests potential as an effective glaucoma screening tool. Additional research must be done to further explore the potential utility of this technology for the use in glaucoma diagnosis, screening, and management.
Reoperations for Complications within 90 days after Glaucoma Surgery

PURPOSE: To describe reoperations in the operating room for complications encountered within 90 days following glaucoma surgery at a single institution over a two-year period.

METHODS: This is a retrospective case series of adult patients who have undergone glaucoma surgery including a tube shunt, trabeculectomy, trabectome or transcleral cyclophotocoagulation from June 1, 2015 to August 30, 2017 at a single institution. These patients were then examined for postoperative complications that required reoperations within the first 90 days including revision of the tube shunt, revision of the trabeculectomy, drainage of the choroidals or placement of a tube shunt.

RESULTS: 622 glaucoma procedures were performed on 600 eyes in 525 patients over a two-year period from June 1, 2015 to June 30, 2017 by four glaucoma surgeons at a single institution. Of these, 276 (44%) were trabeculectomy, 254 (41%) were placement of a tube shunt, 33 (5%) were cyclophotocoagulation, and 61 (10%) were trabectome procedures. Postoperative complications requiring reoperations within 90 days developed in 14 patients (2.3%) overall including 6 patients (2.2%) in the trabeculectomy group and 8 patients (3.1%) in the tube shunt group. Five patients developed bleb leaks, 3 patients developed serous choroidal effusions, 3 patients had tube exposure, 1 patient had tube retraction, 1 patient had persistent iritis from iris touching the tube, and 1 had encapsulation around the tube. There were no complications requiring reoperations in 90 days for transcleral cyclophotocoagulation or trabectome.

DISCUSSION: Several studies have reported on the serious complication rate after surgery requiring reoperation, including the tube versus trabeculectomy study which reported a 7% complication after tube shunt surgery and 5% after trabeculectomy in the first year of follow-up.1 Meanwhile, the Collaborative Initial Glaucoma Treatment Study reported additional procedures performed on 3% of eyes at 1-month postoperative period for surgical complications following trabeculectomies mostly related to the reformation of the anterior chamber or wound leaks.2 Of note, mitomycin C was rarely used. Similarly, Hsia et al3 reported an overall reoperation rate of 3.9% within 90 days following resident-performed glaucoma surgery for trabeculectomy, Ex-PRESS shunt and Ahmed glaucoma valve implant. Our real-world findings are comparable to previous studies.

CONCLUSION: Early postoperative complications requiring reoperations within the first 90 days following glaucoma surgery was low and comparable to previous studies. Common indications for reoperation within 90 days include wound leak and tube shunt-related issues. To the best of our knowledge, published data on three-month reoperation rates secondary to complications following glaucoma surgery is limited.

References:
Name of Author(s): Christine J. Zemsky, BS, Sefy A. Paulose, BS, Ritah Chumdermpadetsuk, BS, Alexis Kassotis, BA, Shelief Robbins-Juarez, BA, Kathleen C. Oktavec, MD, MHS, Priya M. Mathews, MD, MPH, Steven Brooks, MD, Lauren Yeager, MD, Sam Young Yoon, MD, Yesim Yilmaz Demirdag, MD, Joyce Yu, MD, Leejee H. Suh, MD

Abstract Title: Abnormal Corneal Tomography in Pediatric Atopic Population

PURPOSE: Many studies show a higher prevalence of keratoconus in atopic populations. With Pentacam imaging, we hope to identify what early keratoconus looks like on physical examination and on corneal maps.

METHODS: Prospective cohort study screening children in the pediatric allergy clinic at our institution using an autorefractor and Pentacam. Those with suspicious maps suggesting ectasia or with definite ectasia were marked as abnormal. Abnormal was defined as (1) irregular astigmatism (skewed axis/greater than 1.0 D) with or without thin pachymetry (cutoff at 540µm), (2) a steep elevation map (on Belin/Ambrósio Enhanced Ectasia Display) with or without thin pachymetry, (3) steep maximum keratometry value (Kmax ≥ 45.5 D) with thin pachymetry. Those with ectasia or ectasia suspects will be followed in the eye clinic with serial eye exams, Pentacams, and further imaging.

RESULTS: Out of 103 patients screened (ages 5 to 20), 47 were found to be abnormal (n=103, 45.6%), 38 were normal (n=103, 36.9%), and 18 could not be determined due to inadequate imaging (n=103, 17.5%). The abnormals were significantly more myopic and significantly more astigmatic. From those 47 abnormals, 19 were identified as having ectasia or as ectasia suspects and were flagged for follow-up. One patient was noted to have a mother with KCN.

DISCUSSION/CONCLUSIONS: Nearly half of the pediatric atopic population screened were found to be abnormal. Myopia and astigmatism were findings in abnormal maps. Further imaging with other modalities will follow, yielding more detailed results in addition to correlation with severity of systemic findings.
Name of Author(s): Dan A Gong MD, Bryan J Winn MD, Casey J Beal MD, Preston H Blomquist MD, Royce W Chen MD, Susan M Culican MD PhD, Lora R Dagi Glass MD, Gary F Domeracki MD, Jeffrey M Goshe MD, Jeremy K Jones MD, Albert S Khouri MD, Gary L Legault, MD, Timothy J Martin MD, Kelly T Mitchell MD, Ayman Naseri MD, Thomas A Oetting MD, Joshua H Olson MD, Jeff H Pettey MD, Russell W Read MD PhD, Maria A Reinoso MD, Andrew L Reynolds MD, R Michael Siatkowski MD, Jeffrey R SooHoo MD, Grace Sun MD, Misha F Syed MD, Jeremiah P Tao MD, Parisa Taravati MD, Darrell WuDunn MD PhD, Lama A Al-Aswad MD MPH

Abstract Title: Gender Differences in Surgical Case Volume among Ophthalmology Residents

PURPOSE: Although ophthalmology residency programs are approaching balanced gender proportions, it is still unclear whether male and female residents are having similar surgical experiences during training. This study investigated gender differences for cataract surgery and total procedure volume during ophthalmology residency.

METHODS: Retrospective, longitudinal analysis of resident case logs from 23 U.S. ophthalmology residency programs spanning 2005-2017 (n=1,271). Variables analyzed include cataract and total surgical volumes, resident gender, maternity/paternity leave status, program region, and program size.

RESULTS: Being female was associated with performing fewer cataract surgeries and total procedures: on average, male residents performed 176.7 cataract surgeries and female residents performed 161.7 (p<0.001); men performed 509.4 total procedures and women performed 451.3 (p<0.001). 85 of 815 male residents and 71 of 456 female residents took parental leave. Male residents who took paternity leave performed 27.5 more cataract surgeries compared to men who did not take leave (p<0.001), but female residents who took maternity leave performed similar numbers of surgeries as women who did not take leave (p=0.81). Each additional year was associated with a 5.5 (p<0.001) increase in cataract volume and 24.7 (p<0.001) increase in total surgical volume. This increase was not significantly different between genders for cataract volume (p=0.11) but was significantly different for total procedural volume with the increase over time for women lagging behind the increased volume for their male counterparts (p=0.008).

DISCUSSION/CONCLUSIONS: Female residents performed fewer cataract surgeries and total procedures compared to their male counterparts from 2005 to 2017.
INTRODUCTION: Carotid cavernous fistulas (CCF) are abnormal vascular shunts from the carotid artery to the cavernous sinus. They are classified based upon the hemodynamics, etiology and anatomy of the CCF. Hemodynamic classification is most commonly used and divides the fistulas between high flow and low flow. Classically, following treatment of CCF patient’s symptoms and signs significantly improve and often resolve. Recurrence or worsening of symptoms often indicates new abnormal flow.

METHODS: We performed a retrospective review of carotid-cavernous fistulas performed at one institution between 2006-2017. Clinical examination and radiologic images were reviewed with attention to initial presentation and symptoms and signs of recurrence.

RESULTS: We identified 3 cases of delayed recurrent diplopia in patients previously successfully treated for their CCF. The radiologic studies were closely examined and evidence of continued flow and incomplete treatment of the fistula was sought. None of the cases demonstrated abnormalities upon radiologic examination. Additionally, cases were compared to age-matched controls with CCF to identify other delayed changes that may account for their recurrent symptoms and no abnormal pathology was noted.

CONCLUSIONS: Carotid cavernous fistulas are a serious hemodynamic intracerebral event and complete treatment of the fistula is necessary for improvement of both morbidity and mortality. Recurrence of CCF often presents as recurrence of symptoms and often radiographically abnormal flow is identified. In our series of patients, delayed recurrence of diplopia did not demonstrate further abnormalities in flow and therefore questions whether the recurrence of this symptom is definitively related to abnormalities of cavernous sinus flow.
Name of Author(s): Aakriti Garg; Donald C. Hood; Noelle Pensec; Jeffrey M. Liebmann; Dana M. Blumberg

Abstract Title: Macular Damage, as Determined by Structure-Function Staging, is Associated with Worse Vision-Related Quality of Life in Early Glaucoma

PURPOSE: Macular damage is common early in glaucoma and has previously been identified as a significant factor affecting vision-related quality of life (VRQoL) across the spectrum of glaucomatous damage. This report uses structure-function correlation to identify early macular damage and assess its relationship with the National Eye Institute Visual Function Questionnaire (NEI VFQ-25).

METHODS:
Setting: Institutional, non-interventional observational cohort study.
Study Population: 88 eyes of 44 participants with early open angle glaucoma [24-2 mean deviation (MD) better than -6 dB].
Observation Procedure: Focal and diffuse macular defects were identified based on corresponding abnormal regions on probability maps from spectral domain optical coherence tomography (SD-OCT) optic disc and macular cube scans, and 10-2 and 24-2 visual fields (VF).
Main Outcome Measure: VRQoL, as measured by the NEI VFQ-25.

RESULTS:
25/44 (57%) of “worse” eyes (defined by 24-2 VF MD) and 13/44 (31%) of “better” eyes had macular damage. Mean MD (SD) of worse and better eyes were -3.03 dB (±2.3) and -1.15 dB (±1.7), respectively. Compared to those without macular damage, lower NEI VFQ-25 scores were seen in patients with macular damage in the worse eye (85.4 (±9.0) vs. 94.6 (±3.3); p=0.0001) and the better eye (84.8 (±11.1) vs. 91.3 (±6.3); p=0.017). Arcuate damage outside the macula did not affect VRQoL (better eye, p=0.40; worse eye, p=0.87).

DISCUSSION/CONCLUSIONS:
Early glaucomatous macular damage, as detected by abnormal topographical regions on measures of structure and function, is associated with decreased VRQoL. Arcuate damage outside the macula does not have an association with VRQoL in early glaucoma.
Name of Author(s): Xuan Cui, Ying-Ting Tsai, Chun-Wei Hsu, Lijuan Zhang, Nan-Kai Wang, Karen Sophie Park, Chia-Hua Cheng, Stephen H. Tsang

Abstract Title: Enhancing glycolytic metabolism with gene therapy and a small molecule drug attenuates neurodegeneration

PURPOSE: To determine the mechanism of attenuation of the neurodegeneration process in retinitis pigmentosa (RP) by enhancing glycolytic metabolism in photoreceptors using gene therapy and a small molecule drug.

METHODS: To enhance glycolytic metabolism using gene therapy, we created an RP mouse model harboring a Vhl gene that can be exclusively excised in rod photoreceptors using tamoxifen-inducible genetic scissors. We systematically injected tamoxifen in 7-, 8-, and 10-day old RP mice to induce Vhl knockout, reprogram the metabolism towards glycolysis, and assess the neuroprotective effects in rod photoreceptors using electroretinography (ERG), histology, immunostaining, and mass spectrometry. To determine whether these neuroprotective effects can occur using a small molecule drug, we orally administered an FDA-approved small-molecule VHL inhibitor to Pde6b RP mice every two days from postnatal day 5 and evaluated the effects using histology and mass spectrometry.

RESULTS: Based on histology and immunostaining, we observed increased outer nuclear layer (ONL) thickness and preserved rod and cone photoreceptors in the tamoxifen-injected mice. ERG showed that the retinal function was well preserved after increasing glycolytic metabolism in rods. In RP mice that were administered the small molecule drug, glycolytic metabolism increased in the retina, resulting in increased ONL thickness representing preserved photoreceptors as shown by histology.

DISCUSSION/CONCLUSIONS: Metabolic reprogramming through gene therapy and repurposing of a small molecule drug increases glycolytic metabolism, leading to structural and functional perseveration of the retina in a preclinical model of RP.
Name of Author(s): Ruben Jauregui, B.S., Karen Sophia Park, B.A., Jimmy K. Duong, MPH, Vinit B. Mahajan M.D., Ph.D, Stephen H. Tsang M.D., Ph.D

Abstract Title: Quantitative progression of retinitis pigmentosa by optical coherence tomography angiography

PURPOSE:
To analyze changes in vessel density (VD), foveal avascular zone (FAZ) area, and choriocapillaris (CC) blood flow over time and correlate these with ellipsoid zone (EZ) line width and best-corrected visual acuity (BCVA) in patients with retinitis pigmentosa (RP).

METHODS:
The retinal and choroidal vasculature of 28 RP patients were analyzed with spectral domain optical coherence tomography angiography (SD-OCT) and OCT angiography (OCT-A) at two visits at least 6 months apart.

RESULTS:
VD decreased at a rate of $2.42 \pm 0.62 \%$ at the SCP ($P = 0.001$) and $2.41 \pm 0.76 \%$ at the DCP ($P = 0.004$) per year. The FAZ area increased at a rate of $0.078 \pm 0.021 \text{ mm}^2$ per year ($P = 0.001$) at the SCP and $0.152 \pm 0.039 \text{ mm}^2$ per year ($P = 0.001$) at the DCP. No change was observed in the CC blood flow over time ($P = 0.275$). EZ line width had the strongest correlation to VD at the SCP ($r = 0.660$ and $0.635$, $P = 0.001$ and 0.001 for the first and second visit, respectively), while BCVA had the strongest correlation to the FAZ area at the SCP ($r = 0.679$ and $0.548$, $P = 0.001$ and 0.003 for the first and second visit, respectively).

DISCUSSION/CONCLUSIONS:
As RP progresses, VD in the retinal vasculature decreases while the FAZ area increases. Our results suggest that, given the changes in retinal vasculature over time, VD and FAZ area can be used as measures of disease progression and outcomes in clinical trials.
Name of Author(s): Thalmon R. Campagnoli, Zaid Mammo, Stanley Chang

Abstract Title: Association of Lamellar Hole Epiretinal Proliferation with Peripheral Retinal Abnormalities.

PURPOSE:
Changes in foveal architecture in lamellar holes (LMH) have been studied in more detail using spectral domain optical coherence tomography (SD-OCT), including the description of a lamellar hole-associated epiretinal proliferation (LHEP). LHEP differs from conventional epiretinal membrane (ERM) in its appearance, lack of tractional properties and poorer visual outcomes. We evaluated the incidence and risk factors of LHEP formation utilizing SD-OCT imaging, looking more specifically into the association of peripheral retinal abnormalities (tears, atrophic hole, lattice or paving stone degeneration, other peripheral chorioretinal scars or atrophy) and OCT features (residual retinal thickness).

METHODS:
Setting: Institutional, retrospective chart review
Subjects: 63 eyes of 57 subjects, 32 males (25 females), ages 57-90 years (mean age 75.5 years) were evaluated
Observation Procedures: Examinations including visual acuity, standard slit-lamp, indirect biomicroscopy, and SD-OCT were performed
Main Outcome Measures: Presence versus absence of LHEP defined by SD-OCT and correlation with peripheral retinal abnormalities. Analysis of OCT features abnormalities between groups.

RESULTS:
While 44/63 eyes (68.8%) had LHEP diagnosis, 20 (45.5%) of those eyes had associated peripheral retinal abnormalities indicating that the presence of peripheral retinal abnormalities significantly correlates with LHEP formation (p<0.05). Fifteen (78.9%) of the 19 eyes with lamellar hole not associated with epiretinal proliferation did not present peripheral retinal abnormalities on examination. The residual retina was thinner in eyes with LHEP than in eyes with lamellar hole not associated with epiretinal proliferation (average 103 microns versus 149 microns between groups).

DISCUSSION/CONCLUSIONS:
The incidence of LHEP is associated with the occurrence of peripheral retinal abnormalities. The presence of thinner residual retina in eyes with LHEP may correlate with poorer visual outcomes observed in these eyes when compared to eyes with lamellar hole not associated with epiretinal proliferation.
Name of Author(s):  Sebrow Dov, Gal-Or O, Dansingani KK, Dolz-Marco R, Freund KB

Abstract Title: Inner Choroidal Flow Signal Attenuation in Pachychoroid Disease: Optical Coherence Tomography Angiography

PURPOSE:
To study zones of reduced inner choroidal flow signal, foci of reduced inner choroidal thickness, and pathologically dilated Haller layer vessels in eyes with pachychoroid disease using optical coherence tomography (OCT) and OCT angiography.

METHODS:
Patients with treatment-naive pachychoroid disease were recruited. All patients prospectively underwent swept-source OCT and OCT angiography. Zones of reduced choriocapillaris flow were labeled and enumerated. Areas where reduced flow signal was attributable to masking/artifacts were excluded. Regions of inner choroidal thinning were identified on structural OCT and labeled. Overlap between reduced choriocapillaris flow and structural inner choroidal attenuation was quantified using Jaccard indices. The relationship of reduced flow to pachyvessels was recorded.

RESULTS:
Twenty-four eyes of 19 patients were identified. All eyes exhibited at least one zone of reduced flow. A total of 146 flow signal attenuation zones were identified. Sixty-two (42%) of 146 zones showed overlap or proximity with structural inner choroidal thinning. The mean Jaccard index per eye was 0.10 (SD = 0.08). Pachyvessels were spatially related to 100 (68%) of 146 zones of flow attenuation.

DISCUSSION/CONCLUSIONS:
Zones of reduced choriocapillaris flow are prevalent in eyes with pachychoroid disease. Approximately 60% of these zones anatomically correlate with pachyvessels. Inner choroidal ischemia seems related to the pathogenesis of pachychoroid diseases.
Name of Author(s): Marlene Wang, MD, Zaid Mammo MD, Amal Hussnain MD, Cecile Truong BS Royce W.S. Chen MD

Abstract Title: Swept-Source Optical Coherence Tomography to Evaluate Posterior Vitreous Detachment.

PURPOSE: We propose that Swept-Source Optical Coherence tomography (SS-OCT) is non-inferior to biomicroscopy and B-scan ultrasound for the diagnosis of posterior vitreous detachment.

METHOD: Prospective study of 69 eyes (36 patients), all patients were evaluated with B-scan ultrasound, biomicroscopy, and SS-OCT. The agreement between the modalities was characterized using a Kappa statistic.

RESULTS: When evaluating for the presence or absence of a PVD, SS-OCT agreed with B-Scan in 88.4% of eyes, showing good agreement (k = 0.768, CI 0.617 – 0.918). Similarly, SS-OCT showed agreement with biomicroscopy in 85.5% of eyes (k = 0.703, CI 0.533-0.873). Agreement was similar between B-scan and biomicroscopy (85.5% agreement, k= 0.709, CI 0.545- 0.873).

CONCLUSION: SS-OCT is non-inferior to the current gold standard (B-scan ultrasound and biomicroscopy) for the diagnosis of PVD.
Names Author(s): S. Amal Hussnain, MD; Rosa Dolz-Marco, MD, PhD; Joshua L. Dunaief, MD, PhD; Christine A. Curcio, PhD, K. Bailey Freund, MD.

Abstract Title: Speckled Hypoautofluorescence as Sign of Resolved Subretinal Hemorrhage in Neovascular Age-related Macular Degeneration

PURPOSE: To describe a pattern of hypoautofluorescence in eyes with neovascular age-related macular degeneration (AMD) occurring after subretinal hemorrhage in the presence of outer retinal atrophy (ORA) with preserved retinal pigment epithelium (RPE) band.

METHODS: This was a retrospective descriptive analysis of neovascular AMD eyes presenting with subretinal hemorrhage over the last 5 years that underwent serial multimodal imaging. A review of color fundus photographs (CF), fundus autofluorescence (FAF), near-infrared reflectance, and optical coherence tomography (OCT) was performed at baseline and all available follow-up visits.

RESULTS: Eleven eyes of 10 patients (9 female; mean age: 84.1 years) with a mean follow-up of 19.8 months were included. CF showed subretinal hemorrhage that resolved over a mean of 5.5 months. All eyes showed hypoautofluorescence delineating the area of hemorrhage. Discrete multifocal punctate hyperpigmented lesions were observed in 90% of eyes, being markedly hypoautofluorescent and producing a speckled pattern on FAF.

CONCLUSION: Areas of hypoautofluorescence in the absence of RPE atrophy, delimit areas of prior subretinal hemorrhage long after its resolution. This pattern is distinct from that seen in areas of RPE loss; and is also opposite to the hyperautofluorescent pattern seen in areas of persistent subretinal fluid showing ORA on OCT scans.
**Name of Author(s):** Zaid Mammo*, Rosanna Martens, Andrew Kirker, David Albiani, Andrew Merkur, C. Gustavo De Moraes, Stanley Chang, David Maberley

**Abstract Title:** Anatomic and Functional Outcomes of Failed Pneumatic Retinopexy for Primary Rhegmatogenous Retinal Detachment: A Retrospective Case Series

**PURPOSE:** To evaluate the functional and anatomical outcomes of patients who failed pneumatic retinopexy (PR) as a primary treatment for rhegmatogenous retinal detachment (RRD).

**METHODS:** Retrospective consecutive case series of failed primary PRs at a tertiary referral centre. Six-month anatomical and functional outcomes of secondary interventions were compared: Scleral buckle (SB), pars-plana vitrectomy (PPV) and combined PPV and SB (PPV+SB).

**RESULTS:** Out of 267 patients with RRD treated with PR, 73 failed cases with six-month follow-up were included. Average time to failure was 12 +/-3 days (Range: 1-180). Within failed cases, 60% required a secondary intervention within 1-3 days of the original procedure. Percentage of failures attributed to proliferative vitreoretinopathy (PVR) was 4%, 20% and 44% in the PPV, SB and PPV+SB group, respectively (p<0.01, Fisher’s exact test). Missed or new retinal tears were responsible for almost 50% of all failures. The combined single secondary intervention anatomical success rate post-failed PR was 93% (SB (87%, n=15), PPV (96% n=49), and PPV+SB (89%, n=9) (p=0.33, Fisher’s exact test)). Visual acuity (logMAR [Snellen acuity equivalent]) at initial presentation and final follow up were similar for the PPV (1.07 [20/237] and 0.28 [20/38] and SB (1.005 [20/202] and 0.183 [20/30] groups, respectively (p=0.71 and p=0.91, respectively, ANOVA Tukey’s HSD method). Both the PPV and SB groups had better VA at initial presentation and at final follow-up compared to the combined SB+PPV group (1.36 [20/459] (p<0.01) and 0.92 [20/166] (p<0.01), respectively (ANOVA Tukey’s HSD method).

**CONCLUSION:** At final follow-up, equivalent anatomical outcomes were observed for PPV, SB and SB+PPV for failed PRs. Functional outcomes were similar across the PPV and SB groups but superior to those in the PPV+SB group. This could be related to more severe cases of RRD given worse initial visual acuity and unequal representation of PVR as a cause of PR failure within the PPV+SB group.
The Eighteenth Annual John T. Flynn Resident-Fellow Research Day
Edward S. Harkness Eye Institute, 7th Floor Flanzer Amphitheatre
Thursday, June 21, 2018

Name of Author(s): Ashley A. Campbell, Kyle J. Godfrey MD, Robyn Gartrell, Andrew Turk, George Zanazzi, Mahesh Mansukhani, Andrew M. Silverman, David Shan, Thomas D. Hart, Yvonne M. Saenger, Peter Canoll, James Garvin, Michael Kazim

Abstract Title: Next Generation Sequencing and Multiplex Immunofluorescence of Pediatric Optic Nerve Glioma

INTRODUCTION: Optic nerve glioma (ONG) are rare but vision threatening tumors that are typically diagnosed in the first decade of life. Their clinical behavior can be difficult to predict, and phenotypically similar tumors are capable of following a benign or aggressive clinical course.1,2 It has been suggested that pediatric ONG have alterations in the mitogen-activated protein kinase pathway with microglia playing a role in the pathogenesis.3 Given the morbidity and limitations of treatment options in sighted eyes, and the heterogeneity of clinical courses, it is desirable to develop tools that enable prognosis, predict clinical behavior, and provide potential therapeutic targets. To this end, we present our preliminary work using next generation sequencing techniques and multiplex immunofluorescence to aid in the prognosis of pediatric optic nerve glioma with the purpose of informing treatment. The Columbia Comprehensive Cancer Panel (CCCP) is a 467-gene oncology panel developed by pathologists and oncologists at Columbia. Quantitative multiplex immunofluorescence (qmIF) allows targeting staining of tumor specimens to analyze the tumor microenvironment.

METHODS: After IRB-approval was obtained, a retrospective clinical case series of pediatric ONG biopsied or resected between 2000-2017 was performed. Previously obtained, formalin-fixed specimens were analyzed. Tumor DNA was sequenced using the CCCP assay. Samples were stained using qmIF for CD3, CD8, CD68, CD163, HLA-DR, and Olig2. Multispectral images were acquired using Vectra™ and analyzed using inForm™ software and R studio to evaluate density of immune phenotypes within the tumor microenvironment.

RESULTS: 8 consecutive patients with previously biopsied optic nerve glioma were included in the study. Age at presentation ranged from 2-23, with an average age of 7.9 years. There were 4 male patients and 3 female patients. 1 patient had a previously known NF1 mutation. Histopathology demonstrated WHO Grade 1 pilocytic astrocytoma in all 7 cases. Targeted next generation sequencing using the CCCP revealed KIAA1549:BRAF fusion mutations in 2 patients, a combined STED2 + KIAA1549:BRAF fusion mutation in 1 patient, and NF1 mutations in 2 patients. 2 patients demonstrated specimen degradation and have been unable to be analyzed at present time. Multiplex immunofluorescence demonstrated an increased density of CD3+CD8+ T-lymphocytes in patients with the KIAA1549:BRAF fusion mutations, and NF1 mutations. Multiplex immunofluorescence also demonstrated an increase in CD68+ macrophages in the patient with the combined STED2-KIAA1549:BRAF fusion mutations, and the patients with the KIAA1549:BRAF fusion mutations relative to the NF1 and unknown mutations.
CONCLUSION: This preliminary study highlights the potential importance of the STED2 + KIAA1549:BRAF fusion mutation in promoting tumor cell immunity and inhibiting host cell defenses in pediatric optic nerve glioma. NGS technology showed mutually exclusive recurrent KIAA1549:BRAF fusions and NF1 mutations in ONG and 1 novel mutation, SETD2 in an aggressive ONG. QmIF analysis showed higher CD3+CD68 immune infiltration associated with the SETD2 + KIAA1549:BRAF fusion. The finding of distinct patterns of tumor immune cell infiltration by qmIF in the cases of pediatric ONG represents a novel way of analyzing the tumor microenvironment in an attempt to understand the variable clinical behavior of this challenging tumor.

References:
Name of Author(s): Kristen Dunbar, MD
Collaborators: Susel Opresa, Kyle Godfrey MD, Ashley Campbell MD, Alison Callahan MD, Michael Kazim MD

Abstract Title: The Contribution of Enlarged Superior Rectus Muscle to Thyroid Eye Disease—Compressive Optic Neuropathy and Inferior Field Defects

PURPOSE:
This study compares the orbital dimensions of 25 patients (44 orbits) with and without compressive disease by evaluating each individual rectus muscle to orbit area.

METHODS:
A retrospective chart review of 28 orbits with TED-NC and 16 orbits with TED-CON was performed. Axial views of the scans were used to measure the distance between the superior orbital fissure and the anterior projection of the zygomatic bone. This was then used to calculate one-third the distance from the superior orbital fissure, a point consistent with prior studies of apical compression. The coronal view at this point was used to measure the volumes of the orbit, optic nerve, and rectus muscle.

RESULTS:
The combined extraocular muscle to orbit area was greater in those with TED-CON than in those without compressive optic neuropathy (p= 0.001). The superior rectus/orbit area ratio was significantly greater in those with TED-CON (p= 0.019). The inferior rectus/orbit area, medial rectus/orbit area, and lateral rectus/orbit area did not differ significantly between the two groups with p-values of 0.943, 0.229, 0.578 respectively.

DISCUSSION/CONCLUSIONS:
As expected, patients with TED-CON showed a significantly greater muscle to orbital area when measured at a consistent orbital depth. Additionally, the superior rectus muscle was the only extraocular muscle that was significantly larger in TED-CON than noncompressive controls. This suggests that enlargement of the superior rectus muscle makes a significant contribution to the compressive optic neuropathy and potentially explains the inferior visual field deficit.
Abstract Title: Unique Histopathologic Features of the Eyelid Dermatofibroma

PURPOSE: Dermatofibromas are common cutaneous lesions, but rarely occur in the eyelid skin. The reason for the low incidence in the palpebral skin has not been elucidated. In this study, we analyze the histopathologic features of an illustrative case of dermatofibroma and review previously published cases to determine whether eyelid dermatofibroma develops differently from the prototypical dermatofibroma.

METHODS: Histopathologic analysis of a new illustrative case of eyelid dermatofibroma and retrospective review of published cases.

RESULTS: The distinguishing features of the illustrative lesion included a rounder gross appearance, non-acanthotic epithelium, basophilic staining, cellular character, and a paucity of “collagen trapping.” These features deviated from the typical features associated with classic dermatofibroma. Review of the eleven previously published cases of eyelid dermatofibroma revealed that they were more similar in appearance to the illustrative lesion than to classic dermatofibroma.

DISCUSSION: The rarity and histological deviations of the eyelid dermatofibroma suggest that the dermal substrate from which the lesion develops differs from that of the classic dermatofibroma. This difference may be explained microanatomically based on the fact that the dermis of the eyelid is predominantly papillary, whereas the dermis of extrapolpebral skin where dermatofibromas are more common is predominantly reticular.

CONCLUSIONS: Although related, eyelid dermatofibromas appear to be histologically distinct from classic dermatofibromas, owing to the unique dermal composition of the site of origin.
Name of Author(s): Sanjai Jalaj MD, Jason Moche MD, Bryan Winn MD

Abstract Title: Precision Oculofacial Reconstruction Using the Stryker Custom Midface Porous Polyethylene Implant.

INTRODUCTION: No two bony reconstructions of the orbit or midface are the same. While most deformities can be repaired successfully by conventional means utilizing plating and prefabricated implants for reconstruction, some cases do not achieve an adequate cosmetic and functional outcome, especially in cases of chronic displaced facial fractures. Custom designed implants have been utilized elsewhere in craniofacial reconstruction. However, its use in the orbit and midface has been limited. We herein describe the use of 3D-printed custom implants designed utilizing high resolution CT images of the patient and specialized software to repair complicated orbital and midface defects.

METHODS: A single-center, single surgeon retrospective review was undertaken to identify patients who had received a custom implant for orbital and/or midface defects. Data was collected on mechanism of injury, previous surgery, time from onset to custom implant, surgical approach, implant material, rate of complications, and follow up time.

RESULTS: 3 patients received custom Stryker porous polyethylene implants. Two patients suffered from traumatic injuries to the orbit, while one was found to have silent sinus syndrome with orbital volume enlargement. Time from onset to custom implant ranged from 6-14 months. Two patients had previous surgery with inadequate cosmetic and functional outcomes. The patient with silent sinus syndrome received the custom implant without prior intervention. All patients had significantly improved functional outcomes with improvement in symmetry. There were no post-operative complications with follow up ranging from 4 to 20 months.

CONCLUSIONS: The 3D-printed, custom porous polyethylene implant is a useful tool for the orbital surgeon. This technology enables the surgeon to use the patient’s normal contralateral side to design precision implants which facilitate achieving symmetry, especially in cases chronic orbital rim and midface fractures, inadequate previous repair, and silent sinus syndrome with orbital volume expansion.
The Eighteenth Annual John T. Flynn Resident-Fellow Research Day
Edward S. Harkness Eye Institute, 7th Floor Flanzer Amphitheatre
Thursday, June 21, 2018

Name of Author(s): Devon Joiner, Kristen Dunbar, Kyle Godfrey, Michael Kazim

Abstract Title: The Association of Risk of Obstructive Sleep Apnea and the Severity of Thyroid Eye Disease

PURPOSE: To determine the association between the severity of thyroid eye disease (TED) and the risk of obstructive sleep apnea (OSA). We hypothesize that increased risk of OSA is correlated with increased severity of TED.

METHODS: All new patients with TED referred to the Principal Investigator were invited to participate. OSA risk was assessed with the STOP-Bang questionnaire where three points or higher indicated high risk. Patients with high and low STOP-Bang scores were compared to assess the severity of TED as measured by decreased visual acuity, degree of proptosis, restriction of extraocular movements, diplopia, decreased color vision, presence of an afferent pupillary defect (APD), scleral show and mean deviation on Humphrey visual field.

RESULTS: 66 patients were included in the study. Twenty subjects showed a high risk of OSA based on their STOP-Bang score. Color vision loss (p=0.0007), greater proptosis (p=0.0267), diplopia (p=0.0382) and greater visual field mean deviation (p=0.0338) were significantly associated with high-risk STOP-Bang scores. Additionally, decreased visual acuity, reduced ocular ductions and the presence of an APD were more common in the higher risk STOP-Bang group, but did not reach statistical significance.

DISCUSSION/CONCLUSIONS: This study demonstrates that the more severe clinical manifestations of TED were found at a statistically high rate among patients at high risk for OSA. These results suggest the potential for the favorable modification of the clinical behavior of TED through the identification and treatment of patients coincidentally at risk for OSA.