519 High myopia, associated complications and potential treatments
Thursday, May 11, 2017 8:30 AM–10:15 AM
Exhibit/Poster Hall Poster Session
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Organizing Section: Anatomy and Pathology/Oncology

Program Number: 5480 **Poster Board Number:** B0637
Presentation Time: 8:30 AM–10:15 AM
Novel Myopia Genes and Pathways identified from Syndromic Forms of Myopia
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Purpose: This study tests the hypothesis that genes known to cause clinical syndromes featuring myopia also harbor polymorphisms contributing to non-syndromic refractive error.
Methods: Clinical phenotypes and syndromes that have refractive error as a recognized feature were identified using the Online Mendelian Inheritance in Man (OMIM) database. Pathway analysis was undertaken to find biological processes over-represented for identified genes. Genetic variants located within 50 kb of the 119 myopia-related genes were evaluated for involvement in refractive error, by analysis of summary statistics from genome-wide association studies (GWAS) conducted by the CREAM consortium and 23andMe, using both single-marker and gene-based tests.
Results: 154 unique causative genes were identified, with 119 specifically linked with myopia, and 114 representing syndromic myopia (i.e. myopia and at least one other clinical feature). Myopia was the only refractive error listed for 98 genes and hyperopia, the only refractive error for 28 genes, with the remaining 28 genes linked to phenotypes with multiple forms of refractive error. Pathway analysis identified several biological processes already implicated in refractive error development through prior GWAS analyses and animal studies, including extracellular matrix remodeling, focal adhesion, and axon guidance, supporting the research hypothesis. Novel pathways implicated in myopia development included mannosylation, glycosylation, lens development, gliogenesis and Schwann cell differentiation. Hyperopia was linked to different biological processes, mostly related to organogenesis. Comparison with GWAS findings further confirmed that syndromic myopia genes were enriched for genetic variants that influence refractive errors in the general population. Gene-based analyses implicated 21 novel candidate myopia genes (ADAMTS18, ADAMTS2, ADAMTSL4, AGK, ALDH18A1, ASXL1, COL4A1, COL9A2, ERBB3, FBN1, GJA1, GNPTG, IFIH1, KIF11, LTBP2, OCA2, POLR3B, POMT1, PTPN11, TFAP2A, ZNF469).
Conclusions: Common genetic variants within or nearby genes that cause syndromic myopia are enriched for variants that cause non-syndromic (common) myopia. These variants account for some of the missing heritability for refractive error. Analysis of syndromic forms of refractive error can provide new insights into the etiology of myopia and identify potential targets for therapeutic interventions.
Commercial Relationships: Daniel I. Flitcroft, None; **James Loughman**, None; **Christine F. Wildsoet**, None; **Cathy Williams**, None; **Jeremy A. Guggenheim**, None

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Presentation Time: 8:30 AM–10:15 AM
Exome Sequence Analysis of 14 High-Grade Myopia Families
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Purpose: To identify causal gene mutations in a cohort of 14 families with autosomal dominant high-grade myopia using exome sequencing.
Methods: Genomic DNA from selected individuals in 14 large Caucasian families with high-grade myopia was obtained and analyzed through exome sequencing. Variants were filtered through a multi-step process, and potential pathogenic variants were confirmed by Sanger sequencing. Additional available affected and unaffected family members were screened for co-segregation of each variant with high-grade myopia when available. Candidate genes and chromosomal loci previously associated with myopic refractive error and its endophenotypes were also screened.
Results: A total of 102 rare/novel heterozygous variants in as many genes were identified in 10 out of 14 probands. Each variant was nonsynonymous and co-segregated with affection status. Of the 102 variants, none were identified in genes known to cause myopia or in genes closest to single nucleotide polymorphisms of refractive error genome-wide association studies (GWAS). Ten variants were identified within myopia-associated loci. Twenty-nine of the variants were novel changes. Variants were not identified in more than one family.
Conclusions: Ten variants within loci associated with myopia were found in seven families with high-grade myopia, two of which were novel. No novel/rare gene variants identified by published GWAS for refractive error or its endophenotypes were noted in our cohort. We identified an additional 92 variants, 29 of which were novel, as candidates for pathogenicity in high-grade myopia. These variants will require future study in additional patients with high-grade myopia, functional analysis, and/or animal modeling in order to determine their role in the phenotype. Nevertheless, variants that are novel or located within myopia-associated loci presented in this study provide new genes for consideration in the pathogenesis of high-grade myopia, and may aid in the development of genetic profiling of those at greatest risk for attendant ocular morbidities of this disorder.
Commercial Relationships: Terri L. Young; **Bethany Kloss**, None; **Stuart W. Tompson**, None; **Kristina N. Whisenhunt**, None; **Samuel Huang**, None; **Krystina Quow**, None; **Derek Pavelec**, None; **Thomas Rosenberg**, None
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Presentation Time: 8:30 AM–10:15 AM
The change in AL/CR progression and spherical equivalent progression may predict the risk of high myopia
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Purpose: To investigate the axial length and corneal radius of curvature (AL/CR) ratio in high versus low myopes and its relationship with myopia progression.
Methods: Baseline AL/CR ratio of the right eyes of 310 high myopes (aged 7 to 16; myopia ≤ -6.00D) from the ZOC-BHVI High Myopia Registry (2012- 2013, Guangzhou, China) and 733 low myopes (aged 6 to 16; myopia -0.50D to -3.50D) from Vision CRC studies (2010-2014, Guangzhou, China) were calculated. Exclusion criteria were ocular disease, surgery or previous treatment for myopia. All participants underwent measurement of axial lengths (AL), corneal radii of curvature (CR) and cycloplegic objective refraction. Low myopes were followed 6 monthly for 12 months. Parental myopia was documented. General linear model was used to test the relationship between AL/CR ratio and spherical equivalent (SE) after adjusting for parental myopia, gender, age, and high versus low myopia. The progression in AL/CR ratio with progression in SE was assessed in the slow (≤0.50D) and fast (>0.50D) progressing low myopes.
Results: The mean age of the high myopia group was 12.8±2.3 years; 50% female. The mean SE was -8.5±2.0D (range -6.00 to -19.25D), mean AL was 26.8±1.1 mm (range 24.1–30.1 mm), mean CR was 7.7±0.3 mm (range 7.1–8.5 mm), mean AL/CR ratio was 3.5±0.1 (range 3.2–3.8). The mean age of the low myopia group was 10.0±1.9 years; 49% female. Mean AL was 24.5±0.8 mm (22.2 to 27.2 mm), mean CR was 7.8±0.2 mm (6.8– 8.6 mm), mean AL/CR ratio was 3.2±0.1 (3.0–3.4). Age, gender and parental myopia were associated with AL/CR ratio after adjusting for level of myopia. The AL/CR ratio was significantly higher in high myopes ($p<0.001$). The relationship of AL/CR ratio with SE at baseline showed that the rate of increase in SE per unit change in AL/CR ratio was 1.8 times higher in high myopes (SE= -11.9xAL/CR+32.7, R^2=0.39) compared to low myopes (SE= -6.5xAL/CR+18.4, R^2=0.38) ($p<0.001$). The relationship in the progression variables showed that the annual progression in SE per unit progression in AL/CR was 2.6 times higher in the fast progressing (SE progression= -7.5xAL/CR–0.63, R^2=0.27) versus slow progressing low myopes (SE progression=-2.9xAL/CR–0.2, R^2=0.13).
Conclusions: The slopes of the progression in AL/CR ratio versus progression in SE are different in fast progressing and slow progressing low myopes.
Commercial Relationships: Monica Jong, None; **Padmaja Sankaridurg**, None; **Thomas J. Naduvilath**, None; **wayne li**, None; **Mingguang He**, None

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Presentation Time: 8:30 AM–10:15 AM
Biometric Progression in Highly Myopic Eyes: The ZOC-BHVI Guangzhou High Myopia Cohort Study
Xinxing Guo[1, 2], Zhuoting Zhu[1], Ou Xiao[1], Ian G. Morgan[1], Mingguang He[1, 3]. [1]Division of Preventive Ophthal, Zhongshan Ophthalmic Center, Guangzhou, China; [2]Wilmer Eye Institute, Johns Hopkins University, Baltimore, MD; [3]Centre for Eye Research Australia, University of Melbourne, Melbourne, VIC, Australia.
Purpose: Highly myopic eyes pose significantly higher risks of ocular deformation and complications than less myopic eyes. The biometric components and their longitudinal changes of high myopia have largely remained uninvestigated. In this cohort study, we intend to document the biometric progression in high myopia and its determinants.
Methods: In this clinic-based cohort study, participants with high myopia (defined as at least -6.00D of spherical power) in both eyes were followed. Biometric measurements including axial length (AL), anterior chamber depth (ACD), lens thickness (LT), and central corneal thickness (CCT) were obtained from optical low-coherence reflectometry (Lenstar LS900, Haag-Streit AG, Koeniz, Switzerland) before cycloplegia at both baseline and at the follow up. Cycloplegic refraction (three drops of 1% cyclopentolate) was measured using an auto-refractor (KR8800, Topcon Corp. Japan) and spherical equivalent refraction (SER) was calculated. Biometric progression was defined as the rate of change for the biometric components. Multiple regression analysis was performed to explore the associations between biometric components and baseline refraction.
Results: A total of 568 highly myopic participants (mean baseline age: 21.4±12.3 years) were followed for a medium of 2.04 years (range: 1.00~3.97 years). Mean measurements at baseline were 27.28±1.40mm for AL, 3.16±0.28mm for ACD, 3.60±0.35mm for LT, and for 545.07±31.49μm for CCT. At the follow-up, ACD and CCT remained stable, while mean progression rate in the right eyes was 0.15±0.02 mm/year for AL, and 0.04±0.03mm/year for LT. In multiple regression analysis, greater AL progression was associated with younger age (β=-0.378, $P<0.001$) and more myopic baseline SER (β=-0.105, $P=0.01$); while no associations were observed between LT progression and age, sex, or baseline SER.
Conclusions: Unlike mild to moderate myopia, highly myopic eyes continue to elongate when reaching adulthood. Younger age and more myopic refraction contribute to the greater progression rate, which may also serve as risk factors for disease progression.
Commercial Relationships: Xinxing Guo, None; **Zhuoting Zhu**, None; **Ou Xiao**, None; **Ian G. Morgan**, None; **Mingguang He**, None
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Posterior Vitreous Detachment in High Myopia Eyes with Macular Disorders
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Purpose: Posterior vitreous detachment plays a critical role in traction maculopathy, ie. EMT, laminar hole, and epiretinal membrane. In this study, enhanced high-definition optical coherence tomography scans were performed to observe the prevalence of different types of myopic traction maculopathy and their correlation with posterior vitreous status.

Methods: In this cross-sectional study, myopic eyes were examined using the enhanced vitreous imaging (EVI) mode and enhanced depth imaging (EDI) mode. According to the findings of vitreous, the eyes were divided into four groups: PPVP group (posterior precortical vitreous pockets), VA group (vitreous adhesion), ERM group (epiretinal membrane), and NA group (no adhesion). The types and location of myopic traction maculopathy were recorded and the correlation of epiretinal traction and posterior viterous adhesion were analyzed.
Results: 224 highly myopic eyes of 138 patients were included in this study. Among the 224 highly myopic eyes, the vitreous status of 47 eyes (20.9%) was classified as PPVP status ; that of 55 eyes (24.6%) as VA status; that of 45 eyes (20.0%) as ERM status; that of 77 eyes (34.3%) as NA status. Retinoschisis that included extrafoveal retinoschisis and retinoschisis involved the fovea detected in VA group (40 eyes of 55 eyes, 72.7%)and ERM group(30 eyes of 45 eyes, 66.7%) were more than that in the NA group(25 eyes of 77 eyes, 32.5%, P<0.00001). Highly myopic eyes from PPVP group were younger, less myopia, and had shorter axial length than highly myopic eyes of the other three groups. Hyperreflective lines and dots that may be related to vitreous degeneration can be observed on the vitreoretinal interface and no any types of myopic traction maculopathy were found in PPVP group. There were multiple abnormalities of MTM found in VA and ERM groups, also, the prevalence of most types of abnormalities were higher than NA group.
Conclusions: Vitreoschisis occurred before the formation of traction maculopathy in most in highly myopic eyes. Residual vitreous and epiretinal membrane adhesion can facilitate the formation of myopic traction maculopathy.
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Presentation Time: 8:30 AM–10:15 AM
Vitreous Structure and Visual Function in Myopic Vitreopathy and Posterior Vitreous Detachment
Justin Nguyen, Kenneth M. Yee, Jeannie Nguyen-Cuu, J Sebag. VMR Institute for Vitreous Macula Retina, Huntington Beach, CA.
Purpose: To evaluate vitreous structure and visual function in myopic eyes with and without posterior vitreous detachment (PVD), since it is not known whether myopic vitreopathy is associated with reduced contrast sensitivity (CS) compared to emmetropic controls, and whether PVD further lowers CS. Increased vitreous echodensity is hypothesized to correlate with reduced CS in each case.
Methods: Vitreous structure was assessed by quantitative ultrasonography (QUS), as previously described (IOVS 56:1611–7, 2015). Visual function was evaluated by visual acuity (VA, Snellen decimal) and CS using the Freiburg Acuity Contrast Test (Weber Index, %W: lower score = better CS). 35 myopes (mean age = 52.5 ± 14.1 yrs; average degree of myopia = -5.2 ± 2.9 D; 17 with -1 to -5D, 18 with ≥ -6D) with clinically significant vitreous floaters were compared to 38 age-matched controls (mean age = 51.24 ± 14.6 years; P=0.7092). Myopes without PVD (n=10; age = 36.6 ± 13.1 yrs) were compared to younger controls (N=23; age=43 ± 13.1 yrs; P=0.21). Myopes with PVD (N=25; age = 58.9 ± 8.3 yrs) were compared to older controls (N=15; age = 60.9 ± 7.5 yrs; P=0.45).
Results: Average VA of controls was 0.78 ± 0.16 with no difference between young controls (0.81 ± 0.15) vs. older controls (0.72 ± 0.17; P = 0.095). VA in myopic vitreopathy eyes without PVD (0.68 ± 0.15) was significantly worse than controls (P = 0.0076). There was no significant difference in VA between myopes with (0.66 ± 0.17) and without (0.73 ± 0.05) PVD (P=0.22).
CS in myopes without PVD (3.31 ± 0.9 %W) was significantly worse than young controls (2.04 ± 0.68%W; P=0.0001). CS in myopes with PVD (4.90 ± 1.75%W) was significantly worse than older controls (2.35 ± 0.63; P<0.0001) and myopes without PVD (3.31 ± 0.9 %W; P<0.01).
QUS backscatter in the pre-macular vitreous was significantly higher in myopic eyes with PVD (911.36 ± 383.57 AU) compared to myopic eyes without PVD (532.15 ± 80.51 AU; P=0.034).
Conclusions: Myopic eyes with vitreous floaters have worse VA and CS than age-matched controls. Myopes with PVD have worse CS and QUS than eyes with only myopic vitreopathy. These results suggest that myopic vitreopathy diminishes CS via increased internal vitreous collagen aggregation as reflected by vitreous echodensity. PVD induces even greater premacular vitreous echodensity, further lowering CS probably due to light scattering by the detached posterior vitreous cortex.
Commercial Relationships: Justin Nguyen; **Kenneth M. Yee**, None; **Jeannie Nguyen-Cuu**, None; **J Sebag**, None

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Presentation Time: 8:30 AM–10:15 AM
Characteristics and outcomes of patients with myopic foveoschisis
Alexander R. Bottini[1], Joseph J. Tseng[1, 2], Michael Rothschild[1], Kenneth J. Wald[1, 2]. [1]Ophthalmology, New York University School of Medicine, New York, NY; [2]Retina Associates of New York, New York, NY.
Purpose: Myopic foveoschisis (MF) in patients with myopic degeneration was not well appreciated prior to the advent of high resolution optical coherence tomography (OCT) imaging. Information is still limited on the clinical course of patients with MF. In our study we aim to provide additional data on the clinical outcomes of patients with MF.
Methods: We performed a retrospective review of patients with a diagnosis of myopic degeneration with posterior staphyloma from a New York City retinal subspecialty practice to identify patients with evidence of MF present on OCT. In cases of MF the demographic data, clinical course, and imaging, including OCT and fluorescein angiography, were evaluated.
Results: 196 patients with myopic degeneration and posterior staphyloma were identified: 9 eyes of 8 patients had MF on OCT. Age at incidence of MF ranged from 47 to 73 years old. Six were females, 2 were males. Mean follow up from incidence of MF was 47 months. Seven of the 8 patients had unilateral MF during the period of observation; one patient developed bilateral MF. Four of the 9 eyes underwent surgery. Of the 5 that did not receive surgery, 2 were noted to have anatomic improvement on OCT and maintained stable acuity and 3 demonstrated stable OCT findings but with a reduction in visual acuity. Of the 4 patients who underwent surgical intervention, 3 of the 4 had repair of macular hole, and one underwent repair of a subtotal retinal detachment. Time from development of MF to time of macular hole development was 4, 11, and 49 months in the 3 eyes. Two of the 3 eyes with macular holes had stable visual acuity following repair, one of the eyes showed improved visual acuity. The retinal detachment was repaired with anatomic improvement of the foveoschisis. Myopic choroidal neovascularization did not develop in any of the 9 eyes during the period of follow up.
Conclusions: Our data are consistent with prior studies indicating that the course of MF is highly variable, ranging from nonprogression

(3/9), spontaneous resolution (2/9) or macular hole formation (3/9). Surgical outcomes can be favorable.
Commercial Relationships: Alexander R. Bottini, None; **Joseph J. Tseng**, None; **Michael Rothschild**, None; **Kenneth J. Wald**, None

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Pseudo-PED in high-myopia
Vito Primavera[1], Teresa Centoducati[1, 2], Riccardo Sacconi[2, 4], Adriano Carnevali[2, 3], Alessandro Rabiolo[2], Maria Vittoria Cicinelli[2], Francesco Gelormini[2], Lea Querques[2], Francesco Bandello[2], Giuseppe Querques[2]. [1]Department of Ophthalmology, Ospedale della Murgia " Fabio Perinei" Altamura, Italy, Castellana Grotte, Italy; [2]Department of Ophthalmology, University Vita-Salute, IRCCS Ospedale San Raffaele, Milan, Italy; [3]Department of Ophthalmology, University of "Magna Graecia", Catanzaro, Italy; [4]Department of Ophthalmology, University of Verona, University hospital of Verona, Verona, Italy.
Purpose: To describe the presence of pseudo-pigment epithelial detachment (PED), a new optical coherence tomography (OCT) finding in high-myopia eyes.
Methods: We reviewed the charts of 30 high-myopia eyes analyzed through spectral-domain OCT using enhanced depth imaging (EDI) technique. Two trained examiners (TC and RS) analyzed six radial scans centered on the fovea. For any of the thirty eyes, subfoveal choroidal thickness was manually measured. In the eyes where pseudo-PEDs were observed, the distance between the fovea and the pseudo-PED was measured along with the pseudo-PED thickness.
Results: Pseudo-PEDs were found in 12 out of 30 eyes (estimated prevalence of 40%; 22-58%, 95% confidence intervals). In all eyes, pseudo-PEDs corresponded to large choroidal vessels that elevated the retinal pigment epithelium (RPE). In the 12 high-myopia eyes with pseudo-PEDs, the mean subfoveal choroidal thickness was 38.9+/- 31.7 µm, which was significantly lower than in high-myopia eyes without pseudo-PEDs (87.8+/- 52.8 µm; p=0.004); choroidal thickness was 82.9+/-36.0 µm in correspondence of the pseudo-PED. In 10 out of 12 eyes with pseudo-PEDs, this finding was observed within the macular area. In 9 out of 12 eyes with pseudo-PEDs (75 %) we found areas of patchy atrophy, which was significantly lower than in high-myopia eyes without pseudo-PEDs (4 out of 18 cases; p=0.008).
Conclusions: Pseudo-PEDs were often detected in high-myopia eyes and correspond to RPE elevation due to the presence of an underlying large choroidal vessel without evidence of sub-RPE pathological findings. They are more likely to appear in high-myopia eyes with thinner choroidal thickness and are often associated with patchy atrophy.
Commercial Relationships: Vito Primavera, None; **Teresa Centoducati**, None; **Riccardo Sacconi**, None; **Adriano Carnevali**, None; **Alessandro Rabiolo**, None; **Maria Vittoria Cicinelli**, None; **Francesco Gelormini**, None; **Lea Querques**, None; **Francesco Bandello**, None; **Giuseppe Querques**, None

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Presentation Time: 8:30 AM–10:15 AM
Comparison of clinical features between anatomic stable group and spontaneous improved group by OCT imaging in myopic macular schisis eyes
Bingqian Liu, Lin Lu, Yonghao Li. Zhongshan Ophthalmic Center, Sun Yat-sen University, Guangzhou, China.
Purpose: To compare the clinical features of myopic macular schisis eyes between anatomic stable group and self improved group according to OCT follow up.
Methods: Myopic macular schisis eyes during long-term follow up in the High Myopia Rearch Group of Zhongshan Ophthalmic Center, Sun Yat-sen University were divided into two groups according to OCT features. The data of age, visual acuity, axial length, and refractive error was compared between the two groups.
Results: A total of 84 eyes were found anatomic stable, 8 eyes showed spontaneous improvement according to OCT follow up. The mean age was 53.7±10 and 51.8±14 years; mean axial length was 29.61±1.75mm and 28.80±1.03mm (p=0.05),the mean refractive error was -14.57±4.02 and -10.98±3.56 (p<0.05) respectively. The BCVA in anatomic stable group decreased from 0.53±0.45 in first visit to 0.62±0.56 in last visit (p<0.05), while the BCVA in spontaneous improved group changed from 0.49±0.43 in first visit to 0.64±0.48 in last visit (p>0.05).
Conclusions: The BCVA showed significant decrease in anatomic stable group, while kept stable in self improved group during follow up. Those eyes with a shorter axial length, less severe myopia in younger patients tend to improved spontaneously.
Commercial Relationships: Bingqian Liu; **Lin Lu**, None; **Yonghao Li**, None

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Presentation Time: 8:30 AM–10:15 AM
Baseline parameters of the HELP study (long-term observation of Caucasians with pathologic myopia): distribution of age in pre-defined risk categories for developing a myopic choroidal neovascularization
Charlotte Melzer[1], Focke Ziemssen[2], Nicole Eter[3], Christian K. Brinkmann[1], Hansjuergen Agostini[4], Gisela Haeusser-Frueh[5], Schargus Marc[7], Katrin Lorenz[6], Frank G. Holz[1], Steffen Schmitz-Valckenberg[1]. [1]Department of Opthalmology, University of Bonn, Grade Reading Center, Bonn, Germany; [2]Department of Ophtalmology, Eberhard Karl University Tuebingen, Tuebingen, Germany; [3]Department of Ophtalmology, University of Muenster, Muenster, Germany; [4]Eye Center, University of Freiburg, Freiburg, Germany; [5]Novartis Pharma, Nuremberg, Germany; [6]Department of Ophtalmology, University of Mainz, Mainz, Germany; [7]Schweinfurt Eye Hospital, Schweinfurt, Germany.
Purpose: This German research project is a prospective observational study in Caucasians with pathologic myopia and pre-defined disease patterns. The intention is to assess the natural progression of this disease within three years and to identify potential risk factors for the development of myopic choroidal neovascularization (mCNV).
Methods: Initially it was planned to enroll 50 patients per risk group, in total 250 subjects in a multicenter approach. The inclusion criteria, five different morphological risk factors in the study eye, were approved by an independent central reading center (CRC). Apart from an axial length of ≥ 26 mm the pre-defined groups where defined as: (1) subfoveal choroidal thinning < 50 µm, (2) choroidal curvature length > 6300 µm, (3) lacquer cracks, (4) patchy atrophy > 5 mm^2 and (5) preexisting mCNV in the fellow eye (German Clinical Trial Register DRKS00007761).
Results: After 2 years of recruitment, a total of 153 patients (66% females) with a mean age of 57.2 years (± 12.7), ranging from 21.9 to 86.2 years, were included. Age distribution was similar for the two groups subfoveal choroidal thinning and lacquer cracks, with a mean age of 57.1 (n=51) and 54.4 years (n=50) respectively. In the patchy atrophy group, data showed a shift in distribution to older patients (mean 63.7 years, n=22). Patients with preexisting mCNV in the fellow eye showed a mean age of 56.4 years (n=22). Furthermore it

was shown that the risk factor choroidal curvature (5% of the total population, n= 8) was rarely found in the Caucasian population.
Conclusions: The HELP study is the first study that prospectively analyses risk factors for the development of mCNV in Caucasians in a large cohort. The data presented here suggest that the increased choroidal curvature, as defined by the protocol and described in the literature, is less frequent in Caucasians than in Asian population and the risk factor patchy atrophy might occur mainly in elderly Caucasian patients.
Commercial Relationships: Charlotte Melzer, Heidelberg Engineering (F), Optos (F), Novartis Germany (R), Zeiss (F), Novartis Germany (F); **Focke Ziemssen**, Alcon (R), Bayer Healthcare (R), Boehringer-Ingelheim (C), Novartis Germany (C), Alimera (C), Allergan (R), Novartis Germany (R), Biogen (R), Allergan (C), Bayer Healthcare (C); **Nicole Eter**, Bausch and Lomb (C), Roche (C), Bayer (C), Bayer (R), Novartis Germany (F), Allergan (F), Novartis Germany (C), Alimera (C), Heidelberg Engineering (R), Allergan (R), Novartis Germany (R), Bayer (F), Allergan (C); **Christian K. Brinkmann**, Novartis Germany (C), Newtricious (C), Heidelberg Engeneering (F), Heidelberg Engineering (C), Novartis Germany (F), Zeiss Meditec (F), Newtricious (F); **Hansjuergen Agostini**, Novartis Germany (C), Novartis Germany (F); **Gisela Haeusser-Frueh**, Novartis Germany (E); **Schargus Marc**, None; **Katrin Lorenz**, Novartis Germany (C); **Frank G. Holz**, Gentech/Roche (F), Zeiss (R), Boehringer-Ingelheim (C), Allergan (F), Thea (C), Optos (F), NigtstarX (F), Bioeq (C), Allergan (R), Heidelberg Engeneering (F), Heidelberg Engeneering (C), Zeiss (F), Acucela (F), Bayer (C), Novartis Germany (F), Bayer (R), Gentech/Roche (R), Merz (C), Novartis Germany (C), Gentech/Roche (C), Novartis Germany (R), Acucela (C), Heidelberg Engeneering (R), Bayer (F), Bioeq (F); **Steffen Schmitz-Valckenberg**, Gentech/Roche (F), Heidelberg Engineering (F), Alcon/Novartis Germany (C), Bayer (R), Gentech/Roche (R), Allergan (F), Gentech/Roche (C), Formycon (F), Optos (F), Allergan (R), Heidelberg Engineering (R), Carl Zeiss MediTec (F), Alcon/Novartis Germany (F), Bayer (F)

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Retinal complications related to myopia and high myopia in a large multicentric cohort of French individuals
Olivier Lichtwitz[1], Emilie Matamoros[1], Pierre INGRAND[1], Francois M. Pelen[2], yannick lefèvre[2], Patrice Pouts[2], yacine bentaleb[2], Nicolas LEVEZIEL[1]. [1]university hospital, Poitiers, France; [2]Point vision, Paris, France.
Purpose: Myopia is one of the first causes of visual impairment worldwide. The aim of this study is to describe the prevalence of retinal complications related to myopia and high mypoia in a multicentric cohort of individuals.
Methods: This cross-sectional analysis was carried out in eye clinics dedicated to refractive errors. Data collection included age, gender, refractive
subjective error on both eyes and any relevant ocular history. Four different groups of individuals with Mild Myopia (-0.5 to -2.75D), Moderate Myopia (-3 to -5.75 D) and High Myopia (-6 to -7.75D and less than -10D) were analyzed. Spherical equivalent of the right eye was exclusively analyzed. Retinal complications mainly included staphyloma, lacker cracks, myopic choroidal neovascularization and chorioretinal atrophy.
Results: Data files from 537 573 individuals (54.7% of women) were analyzed. The mean age was 38 years old (SD: 17.5 years). Overall prevalence of myopia was 37.3% (95% CI 37.2-37.4%). Prevalences of mild, moderate, high and very high myopia were respectively 24.6%, 9.7%, 2.5% and 0.5%. Prevalences of staphyloma were of 0.5% and 3.6% in the high and very high myopia groups. Prevalences of other macular complications related to myopia will be presented during the congress.
Conclusions: This large cohort provides new insights in terms of prevalences of retinal complications related to myopia regarding to the degree of myopia. These results confirm the importance of myopia as a major health issue in Western countries.
Commercial Relationships: Olivier Lichtwitz, None; **Emilie Matamoros**, None; **Pierre INGRAND**, None; **Francois M. Pelen**, point vision (I); **yannick lefèvre**, pointvision (I); **Patrice Pouts**, pointvision (I); **yacine bentaleb**, pointvision (I); **Nicolas LEVEZIEL**, pointvision (C)

Program Number: 5491 **Poster Board Number:** B0648
Presentation Time: 8:30 AM–10:15 AM
Parapapillary Delta Zone as Risk Factor for Glaucoma in High Myopia
Jost B. Jonas[1], Kyoko Ohno-Matsui[2], Natsuko Nagaoka[2], Pascal Weber[1]. [1]Ophthalmology, Medical Faculty Mannheim-Heidelberg, Mannheim, Germany; [2]Department of Ophthalmology and Visual Science, Tokyo Medical and Dental University, Tokyo, Japan.
Purpose: To examine the prevalence and associated factors of glaucomatous optic neuropathy (GON) in a medium myopic to highly myopic patients.
Methods: The retrospective observational hospital-based study included patients who had attended the Tokyo High Myopia Clinics within January 2012 and December 2012 and for whom fundus photographs were available. GON was defined based on the appearance of the optic nerve head on the fundus photographs
Results: The study included 519 eyes (262 individuals) with a mean age of 62.0±14.3 years (range:13-89 years) and mean axial length of 29.5±2.2 mm (range:23.2-35.3mm). GON was present in 164 (28.1%; 95% confidence intervals (CI):24.4,31.7%) eyes. GON prevalence increased from 12.2% (95%CI:1.7,22.7) in eyes with an axial length of <26.5mm to 28.5% (24.4,32.5), 32.6% (27.9,37.2), 35.6% (30.5,41.1), and 42.1% (35.5,48.8) in eyes with an axial length of ≥26.5mm, ≥28mm, ≥29mm and ≥ 29mm, respectively. In multivariate analysis, higher GON prevalence was associated (Nagelkerke r^2: 0.28) with larger parapapillary delta zone diameter (P<0.001; odds ratio (OR):1.86;95%CI:1.33,2.61), longer axial length (P<0.001;OR:1.45;95%CI:1.26,1.67) and older age (P=0.01;OR:1.03;95%CI:1.01,1.05). If parapapillary delta zone width was replaced by vertical disc diameter, higher GON prevalence was associated (r^2:0.24) with larger vertical optic disc diameter (P=0.04;OR:1.70;95%CI:1.03,2.81), after adjusting for longer axial length (P<0.001;OR:1.44;95%CI:1.26,1.64) and older age (P<0.001;OR:1.04;95%CI:1.02,1.06).
Conclusions: Axial elongation associated increase in GON prevalence (mean: 28.1% in a medium to highly myopic study population) was associated with parapapillary delta zone as surrogate for an elongated peripapillary scleral flange and with larger optic disc size.
Commercial Relationships: Jost B. Jonas, Biocompatibles UK Ltd. (Franham, Surrey, UK) itle: Treatment of eye diseases using encapsulated cells encoding and secreting neuroprotective factor and / or anti-angiogenic factor; Patent number: : 20120263794 (P), Mundipharma Co (C), patent application with University of Heidelberg (Heidelberg, Germany) (Title: Agents for use in the therapeutic or prophylactic treatment of myopia or hyperopia; Europäische Patentanmeldung 15 000 771.4). (P);

Kyoko Ohno-Matsui, None; **Natsuko Nagaoka**, None; **Pascal Weber**, None
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Program Number: 5492 **Poster Board Number:** B0649
Presentation Time: 8:30 AM–10:15 AM
Observation of Paravascular Abnormalities by Optical Coherence Tomography and Relation to Retinoschisis in Highly Myopic Eyes
Xiaodong Sun, Tong Li, Fenghua Wang. Ophthalmology, Shanghai First Peoples Hospital, Shanghai, China.
Purpose: To investigate the retinal features and distribution of paravascular abnormalities (PVAs) and its relationship with retinoschisis and myopic maculopathy classification in highly myopic eyes.
Methods: The cross-sectional study evaluated 152 eyes of 88 patients with high myopia who had undergone complete ophthalmic examinations. Multiple optical coherence tomography (OCT) scans were performed to study the microstructural alterations at retinal vascular arcades and entire macular area. Myopic maculopathy was classified based on the International Classification of Myopic Maculopathy. The presence of various PVAs, retinoschsis, myopic maculopathy and the association between these parameters were analyzed.
Results: Of the 152 highly myopic eyes, PVAs were detected by OCT in 126 eyes (82.9%), including paravascular microfolds in all 126 eyes, paravscular cysts in 108 eyes (71.1%), and paravascular lamellar holes in 40 eyes (26.3%). Patients with PVAs were significantly older, had higher spherical equivalent (SE), longer axial length (AL), higher incidence of retinoschisis at vascular arcades and macular retinoschisis. All the three types of PVAs were observed more frequently along the temporal vascular arcades than the nasal vascular arcades ($P < 0.005$). All of the 78 eyes (51.3%) with retinoschsis at vascular arcades had PVAs. Retinoschisis at vascular arcades was observed most frequently in eyes with all three types of PVAs ($P < 0.001$) and was independently correlated with age, AL, paravascular cysts and lamellar holes. Macular retinoschisis was detected in 26 eyes (17.1%) and was associated with SE, presence of traction structure at macular area and inner limiting membrane (ILM) detachment at vascular arcades. PVAs were most frequently demonstrated in fundus with diffuse chorioretinal atrophy.
Conclusions: Highly myopic eyes were susceptible of PVAs, and the lesions were mainly observed along the temporal vascular arcades. The development of macular retinoschsis could be a result of progression of myopia and intraocular forces, especially the traction of vitreous at macular area, and the splitting of ILM along the vascular arcades which is associated with the formation of paravascular lamellar holes. The incidences of PVAs differed in eyes with various categories of myopic maculopathy. Retinae retaining integrity and thickness were more likely to be affected by PVAs.
Commercial Relationships: Xiaodong Sun, None; **Tong Li**, None; **Fenghua Wang**, None
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Presentation Time: 8:30 AM–10:15 AM
Interlink among Retinal Perfusion, Macular Structure, and Retinal Sensitivity Measurements in High Myopia
Yimin Yuan, Qiuyan Wu, Qi Chen, Meixiao Shen, Fan Lu. School of Ophthalmology & Optometry; The Eye Hospital, Wenzhou Medical University, Wenzhou, China.
Purpose: To determine the correlation of structural and functional changes visualized using high-resolution optical coherence tomography (OCT) with microperimetric retinal sensitivity in high myopia.
Methods:
Cross-sectional study. Thirty-one eyes of 31 patients with high myopia were age-matched with Thirty-one normal eyes of 31 subjects. All subjects underwent OCT and MP1 microperimeter measurements to obtain the parameters of retinal perfusion, macular structure, and retinal sensitivity. Pearson correlation analysis was performed to analyze the relationship among retinal perfusion, macular structure, and retinal sensitivity in high myopia.
Results: The parameters obtained from OCT angiography indicated that retinal perfusion were reduced in high myopic eyes compared to controls. The total thickness of outer retinal layer and retinal pigment epithelium layer (ORLRPE), as well as choroidal thickness, were thinner than those in controls. The retinal sensitivity were reduced in high myopia eyes compared to controls ($P < 0.001$). Retinal sensitivity loss was correlated with both choroidal thinning ($r=0.416$, $P=0.020$) and structural loss of ORLRPE ($r=0.405$, $P=0.024$). There was no correlation or paradoxical correlation between retinal perfusion and retinal sensitivity ($P> 0.05$).
Conclusions: It appears that there is a close link among choroidal thinning, structural loss of ORLRPE and retinal sensitivity defect in high myopia. We hypothesize that reduced retinal perfusion from the choroidal in high myopia may occur before the structural and functional changes of the retina. A follow-up cohort study of high myopic subjects is planned to address the hypothesis.
Commercial Relationships: Yimin Yuan, None; **Qiuyan Wu**, None; **Qi Chen**, None; **Meixiao Shen**, None; **Fan Lu**, None
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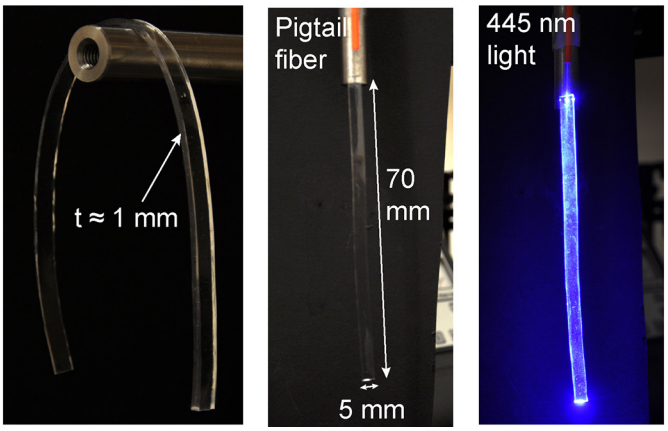
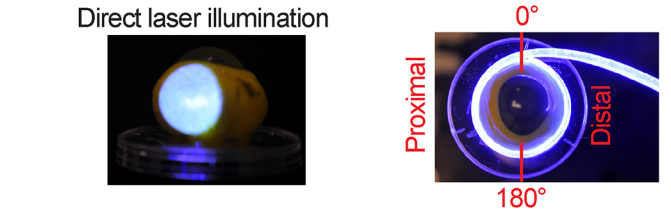
Presentation Time: 8:30 AM–10:15 AM
Ranibizumab therapy for Myopic CNVM
Hetvi Bhatt[1, 2], Oluremi Adenuga[2], Ranjit Sandhu[2], Venki Sundaram[2], Mala Subash[2]. [1]Ophthalmology, NHS Forth Valley, Falkirk, United Kingdom; [2]Ophthalmology, Luton and Dunstable University Hospital, Luton, United Kingdom.
Purpose: Choroidal neovascular membrane (CNVM) is a vision threatening complication of myopia. Previous treatment options included laser photocoagulation and verteporfin photodynamic therapy; however, recently anti-Vascular Endothelial Growth Factor (VEGF) therapy has superseded these methods. We performed a retrospective observational clinical study to compare visual outcomes following intravitreal ranibizumab (0.5mg) injections for myopic CNVM at a United Kingdom District General Hospital with outcomes from published data.
Methods: This analysis included all patients receiving ranibizumab injections for myopic CNVM in the previous 2 years. Using our electronic records, we gathered data on patient demographics, refraction and EDTRS visual acuity at baseline, 3 months, 6 months and at final follow up.
Results: There were 13 patients, aged between 26 and 85. Mean spherical equivalent of the treated eye was -8.86D, with a range from

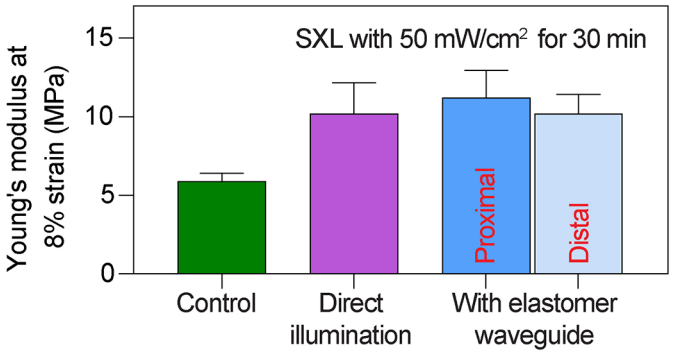
-30.25D to -0.5D (n=9). Best-corrected visual acuity (BCVA) at baseline was 52.3±24.1 letters, improving to final BCVA 66.8±13.9 (p=0.009). An increase of 14.5±16.7 letters was seen in our treatment group. Total number of injections for our patients was 6.5±4.4. Mean follow-up was 12 months (range 3-26). It was also noted that patients with a worse presenting BCVA responded equally well to those with a better presenting BCVA, refraction had no real affect on visual outcome and younger patients responded better to treatment. There were no treatment related adverse events.
Conclusions: In comparison with published data, our study shows comparable improved visual outcomes which appears to be sustained at long term follow-up when treating myopic CNVM with ranibizumab. Treatment of myopic CNVM with ranibizumab achieves a more rapid stabilisation with fewer injections and a higher chance of improving baseline visual acuity compared to treating age-related macular degeneration. Collective data will pave the way to establishing optimum dosing frequency and monitoring intervals.
Commercial Relationships: Hetvi Bhatt, None; **Oluremi Adenuga**, None; **Ranjit Sandhu**, None; **Venki Sundaram**, None; **Mala Subash**, None

Program Number: 5495 **Poster Board Number:** B0652
Presentation Time: 8:30 AM–10:15 AM
Flexible optical waveguides for uniform periscleral crosslinking
Sheldon J. Kwok[2, 1], Moonseok Kim[1], Harvey H. Lin[1], Theo G. Seiler[1], Eric Beck[1], Marleen Engler[1], Peng Shao[1], Irene E. Kochevar[1], Theo Seiler[3], Seok Hyun Yun[1, 2]. [1]Wellman Center for Photomedicine, Massachusetts General Hospital, Cambridge, MA; [2]Harvard-MIT Health Sciences and Technology, Massachusetts Institute of Technology, Cambridge, MA; [3]Institut für Refraktive und Ophthalmo-Chirurgie, Zurich, Switzerland.
Purpose: Scleral crosslinking (SXL) with a photosensitizer and light is a promising strategy to mechanically reinforce the sclera and prevent the progression of pathologic myopia. Current approaches for light delivery to the sclera are invasive, involving complicated surgery, and do not provide uniform illumination, which could lead to astigmatism. To overcome these challenges, we have developed flexible optical waveguides optimized for efficient, homogeneous light delivery, and demonstrate their application for SXL.
Methods: Waveguides were fabricated from polydimethylsiloxane elastomer. Light is coupled into the waveguide with an input fiber (NA=0.22) connected to a 445 nm laser. Light extraction efficiency from the waveguide to scleral tissue was measured and fit to a theoretical model. To demonstrate SXL *ex vivo*, fresh porcine eyes were stained with 0.5% riboflavin for 30 minutes. SXL was performed using irradiances of 0,25,50 mW/cm^2 on equatorial sclera over the entire circumference of the eyeball. SXL with elastomer waveguides was compared to direct laser illumination at the same irradiances. At least 5 eyes were used per condition. Scleral strips were dissected and characterized with tensiometry to measure Young's moduli.
Results: Light delivery with a waveguide of tapered thickness (1.5 to 0.5 mm) enhanced the uniformity of light distribution compared to a flat waveguide (~1 mm), from a coefficient of variation of 28% to just 10%. SXL treatment significantly increased the stiffness of equatorial sclera compared to control. At 8% strain, sclera treated with the waveguides at 50 mW/cm^2 for 30 min had a modulus of 10.7 ± 1.0 MPa, compared to 5.9 ± 0.5 MPa for no irradiation (two tailed p<0.001). There was no difference in stifness between the proximal and distally treated halves of the sclera, and no difference between SXL with elastomer and with direct illumination (10.2 ± 1.9 MPa).
Conclusions: We have developed flexible polymer-based waveguides for periscleral crosslinking. Our technique enables efficient and homogeneous stiffening of the sclera with minimal invasiveness. Using our waveguides, SXL on fresh porcine eyes resulted in a near 2-fold increase in the Young's modulus of sclera compared to untreated eyes. Further studies with Brillouin imaging will characterize the uniformity of SXL-induced stiffening. In vivo studies using our waveguides on rabbit eyes are underway.



Elastomer waveguides





Tensiometry results

Commercial Relationships: Sheldon J. Kwok, Massachusetts General Hospital (P); **Moonseok Kim**, Massachusetts General Hospital (P); **Harvey H. Lin**, None; **Theo G. Seiler**, None; **Eric Beck**, None; **Marleen Engler**, None; **Peng Shao**, None; **Irene E. Kochevar**, None; **Theo Seiler**, None; **Seok Hyun Yun**, Massachusetts General Hospital (P)
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