A comparison of image quality between swept source optical coherence tomography and spectral domain optical coherence tomography according to ocular media opacity


Purpose: To compare of image quality between swept source optical coherence tomography (SS-OCT) and spectral domain OCT (SD-OCT) according to various ocular media opacity

Methods: 20 healthy eyes without media opacity and 40 eyes with media opacity (20 eyes with cataract, 15 eyes with vitreous opacity, 5 eyes with corneal opacity) were included in this study. All subjects performed same scan protocol (6x6 mm macular scan) of both SD-OCT and SS-OCT sequentially. For the comparison of image quality, a total of 120 OCT images were subjectively graded by two trained retina specialist using qualitative OCT image grading system (0-9) suggested by previous report. In addition, we measured image quality factor (Q-factor) of all OCT images provided by each OCT device for objective assessment.

Results: The image quality of SS-OCT was better than that of SD-OCT in both healthy eyes and the eyes with medial opacity, which was statistically significant in both subjective (7.79 vs 2.91) and objective (106.82 vs 32.49) assessment (P<0.05). Regardless of the type of media opacity, SS-OCT showed better image quality than SD-OCT. In cases with healthy eyes, there was no statistical difference in subjective interpretation between two OCT devices. In cases with severe media opacity, SD-OCT did not show detailed microstructure of retina such as external limiting membrane and photoreceptor layer, while SS-OCT did clearly.

Conclusions: Recently introduced SS-OCT used longer wavelength light source than SD-OCT, which may lead to good image quality in eyes with media opacity. SS-OCT may be useful in the evaluation of retinal disease in cases with severe media opacity.
Correlation between the Position of Retinal Nerve Fiber Layer Peak and the Position of Retinal Major Vessels in Healthy Korean Eyes

Seungsoo Rho1, 4, Caleb Jee Hyun Park2, Youngje Sung1, Won Kyung Song1, Saechen Rho1, Hyoung Won Bae1, Sang Yeop Lee1, Chan Yun Kim2.

1Ophthalmology, CHA Bundang Medical Center, CHA University, Seongnam, Republic of Korea; 2Center for Program Analysis and Evaluation, Security Management Institute, Seoul, Republic of Korea; 3Ophthalmology, Dong-A University College of Medicine, Busan, Republic of Korea; 4Institute of Vision Research, Department of Ophthalmology, Yonsei University College of Medicine, Seoul, Republic of Korea.

Purpose: We hypothesized that the location of retinal major arteries and veins can affect the location of retinal nerve fiber layer (RNFL) peak. We sought to assess the correlation between the position of the retinal major vessel and the position of the RNFL peak.

Methods: The RNFL scans of 52 healthy eyes were enrolled in the study. The average RNFL thickness profiles were obtained using Fourier domain optical coherence tomography (FD-OCT). The location data of RNFL peak were compared to those of major arteries and veins. Superotemporal RNFL peaks (STp) and inferotemporal RNFL peaks (ITp) were assessed with superotemporal major vessels (artery (STA), vein (STV)) and inferotemporal major vessels (artery (ITA), vein (ITV)), respectively. Pearson’s correlation coefficient was used to assess the correlation between the variables, and then a regression equation was formulated using a least square method.

Results: The mean age of the participants were 53.56 ± 10.47 years old. The mean locations of STp and ITp were 76.49 ± 14.08 degree and 290.52 ± 11.25 degree, respectively. STA was more correlated with STa (r=0.819, p<0.001) than STv (r=0.223, p=0.112). ITp was more correlated with ITa (r=0.555, p<0.001) than ITv (r=0.409, p=0.003). According to the extracted regression equation, axial length and the peak position of artery are the key factors determining the peak position of RNFL thickness (adjusted R square = 0.693) in a multiple regression analysis.

Conclusions: In both superotemporal and inferotemporal area, the location of artery is correlated to each RNFL peak. The consideration of major vessel location might be helpful for improving the accuracy of glaucoma detection.

Program Number: 3361 Poster Board Number: C0054
Presentation Time: 11:00 AM–12:45 PM
Optical Coherence Tomography (OCT) Use in Assessing Hydrocephalus

Marisa Gobuty1, Thomas R. Hedges2, Geetha K. Athappilly2, Steven Hwang3. 1Tufts University School of Medicine, Boston, MA; 2Departments of Neurology, Neurosurgery, Ophthalmology, Tufts Medical Center, Boston, MA.

Purpose: Currently, OCT is used to image macular disease and for measurement of the retinal nerve fiber layer (RNFL) thickness in optic nerve disease. OCT is an objective method to measure RNFL thickness in patients with papilledema. Diagnosing shunt malfunction currently relies on using many diagnostic tools, including the clinical history, change in ventricular size on CT, shunt tap findings, shuntograms, MRI, and CSF pressure studies. We hypothesize that OCT may have greater sensitivity and specificity in detecting papilledema caused by hydrocephalus and shunt malfunction.

Methods: All patients ages four and over with hydrocephalus are being evaluated before and/or after shunt placement or revision. These patients are prospectively followed with OCT, fundus photographs, and examination.

Results: Fifteen patients have been enrolled to date (eight females, seven males). Diagnoses include hydrocephalus, brain tumors, Chiari malformation, and pseudotumor. One pediatric patient had a new diagnosis of hydrocephalus with papilledema and two pediatric patients had questionable shunt malfunction. One adult patient had papilledema with a diagnosis of a brain tumor and one adult patient had questionable shunt malfunction.

Baseline average RNFL thickness measurements for pediatric patients without optic atrophy: 85.0 μm (SD 4.06). Baseline average RNFL thickness measurements for pediatric patients with optic atrophy: 66.75 μm (SD 8.12). Baseline average RNFL thickness measurements for adult patients without optic atrophy: 99.1 μm (SD 22.77). Baseline average RNFL thickness measurements for adult patients with optic atrophy: 53.5 μm (SD 5.94).

A fourteen-year-old patient with a new diagnosis of hydrocephalus had elevated RNFL measurements OU, which returned to normal after endoscopic third ventriculostomy surgery. A nine-year-old girl with communicating hydrocephalus and optic atrophy showed microcystic changes in the inner nuclear layer on OCT.

Conclusions: OCT may be a valuable tool to quantitatively assess the development and resolution of papilledema and to detect shunt malfunction in patients with hydrocephalus. Microcystic changes have been previously described in patients with optic neuropathy secondary to hydrocephalus. The significance of this finding is not clearly understood, but may have an impact on the measurement of true retinal thinning in these patients.

Commercial Relationships: Marisa Gobuty, None; Thomas R. Hedges, None; Geetha K. Athappilly, None; Steven Hwang, None

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Commercial Relationships: Giulio Barteselli, None; Dirk-Uwe G. Bartsch, None; Joseph T. Nezgoda, None; Natalia Camacho, None; Amir Marvasti, None; Robert N. Weinreb, None; William R. Freeman, None
Support: NIH Grants R01EY007366 and R01EY018589 (WRF) and R01EY016323 (DUB); Research to Prevent Blindness, Inc, New York, New York; and unrestricted funds from Jacobs Retina Center (La Jolla, California).
Spectral Domain Optical Coherence Tomography in Chiasmal Compression


**Purpose:** To analyze the utility of automated macular ganglion cell layer (GCL) measurements in patients with radiologic evidence of chiasmal compression. To compare GCL measurements to retinal nerve fiber layer (RNFL) thickness, macular thickness and visual fields in affected patients.

**Methods:** Patients with active chiasmal compression on MRI seen between January 2010 and October 2013 were eligible. Age-matched controls were also included. All were studied with the Cirrus HD-OCT macular cube 512x128 and RNFL scan protocols, as well as 30-2 visual fields. One eye was selected at random per person for analysis. T-tests were done comparing RNFL, GCL and macular thicknesses between patients and controls. Effect size (d) was calculated to assess the magnitude of difference between them. Average GCL, RNFL and macular thicknesses were correlated to mean deviation (MD).

**Results:** Twenty-six eyes from 13 patients and 13 controls were enrolled. Ten patients had pituitary adenoma, 2 had tuberculum sella meningioma and 1 had Rathke’s cyst. Six patients had bitemporal hemianopia, 5 did not have field defects and 2 had junctional scotomas. Average GCL thickness was 70±8 μm in patients and 80±5 μm in controls (p=0.001). Average macular thickness was 268±13 μm in patients and 278±9 μm in controls (p=0.03). Average RNFL thickness was 84±13 μm in patients and 90±6 μm in controls (p=not significant). Effect size was greatest for GCL thickness (d=1.44), followed by macular thickness (d=0.91) then RNFL thickness (d=0.64). MD was more correlated to GCL thickness (r2=0.14) than macular (r2=0.005) or RNFL thicknesses (r2=0.05). One patient with follow-up showed baseline nasal GCL thinning, bitemporal field defects, but normal RNFL and macular thicknesses. Post-resection, visual fields normalized with stable nasal GCL thinning.

**Conclusions:** The greatest difference in thickness measurements between patients and controls was in the GCL, followed by macula and least in RNFL, reflected by both p-values and effect sizes. Thinning of the GCL may be detected prior to significant loss of RNFL or macular thickness in these patients. Since GCL thinning is present in patients with normal visual fields after chiasmal decompression, and since it is a more objective measurement, GCL analysis may be the best metric to follow patients with chiasmal lesions.

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**Program Number:** 3364 Poster Board Number: C0057

**Presentation Time:** 11:00 AM–12:45 PM

**Imaging amyotrophic lateral sclerosis (ALS) neurodegeneration through the eye

Nisha Mukherjee1, Anthony N. Kuo1, Richard Bedlack1, Henry Tseng1. Ophthalmology, Duke University Eye Center, Durham, NC; 2Neurology, Duke University Medical Center, Durham, NC.

**Purpose:** Recent studies on optineurin suggest similarities in pathophysiology between glaucoma and neurodegenerative diseases such as amyotrophic lateral sclerosis (ALS), but it is currently unclear whether neurodegeneration occurs in neurons beyond the brain and spinal cord in ALS. We hypothesized that ALS patients may exhibit retinal neurodegeneration, and tested this hypothesis by using spectral domain optical coherence tomography (SD-OCT) imaging.

**Methods:** ALS patients were recruited from the Duke University Medical Center under an IRB approved protocol. We performed visual acuity (VA) testing, intraocular pressure (IOP) measurement, and an anterior and undilated posterior segment evaluation when possible. Retinal neurodegeneration was assessed by measuring retinal nerve fiber layer (RNFL) thickness using SD-OCT (Spectralis; Heidelberg Engineering). Mean RNFL thickness and 6-sector RNFL thickness were compared to the normative database. ALS disease severity was determined through the ALS Functional Rating Scale (ALSFRS-R) scale and analyzed for statistical correlation with RNFL thickness.

**Results:** 16 patients with ALS were enrolled with a mean ALSFRS-R score of 31.8 (±9.9). The male: female ratio was 10:6. The average age was 61.1 years. Mean VA was 20/40 in each eye. IOP in 15 patients were within normal limits and slit lamp examination in all patients were normal. No significant optic nerve cupping was observed. SD-OCT imaging was successfully performed in all ALS patients despite positional challenges resulting from motor deficits. Mean RNFL thickness for this group was 90.06 μm in the right eye (±10.97 μm) and 87.31 μm in the left eye (±13.20 μm). Preliminary assessment did not reveal a correlation between total RNFL thickness and ALS severity.

**Conclusions:** Our study shows that OCT imaging can be performed rapidly and effectively in ALS patients despite positional challenges. While we did not detect significant retinal thinning in ALS patients, future work on sublayer segmentation and analysis are needed. OCT imaging provides a valuable non-invasive technique for evaluating retinal anatomy and neurodegenerative changes. Use of this technology in ALS patients may reveal the utility of using the retina as a biomarker to diagnose and detect progression in ALS.

**Commercial Relationships:** Nisha Mukherjee, None; Anthony N. Kuo, Bioptigen (P); Richard Bedlack, None; Henry Tseng, None

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subfoveal choroidal thickness was higher in AD than in control group (246.31 ±68.23 versus 214.31±72.85 μm; p< 0.05 t student test).

Conclusions: This findings suggest that the macular and retinal degeneration may be multifactorial such as retrograde degeneration in retinal changes and ischemic factor in choroidal changes.

Commercial Relationships: Joao-Paulo Cunha, None; Arnaldo D. Santos, None; Joana Ferreira, None; Duarte Amado, None; Carlota Louro, None; Castanheira Dinis, None

Program Number: 3366 Poster Board Number: C0059
Presentation Time: 11:00 AM–12:45 PM

Sensitivity and Specificity of Fluorescence and Polarimetry of the Retina in Alzheimer’s Disease
Laura Emptage1, Marsha L. Kisilak1, 2, Matthew Wilson1, Zoya Leonenko1, 2, Melanie C. Campbell1, 2. 1Physics and Astronomy, University of Waterloo, Waterloo, ON, Canada; 2School of Optometry and Vision Science, University of Waterloo, Waterloo, ON, Canada. 3School of Optometry and Vision Science, University of Waterloo, Waterloo, ON, Canada; 3School of Optometry and Vision Science, University of Waterloo, Waterloo, ON, Canada; 3School of Optometry and Vision Science, University of Waterloo, Waterloo, ON, Canada; 3School of Optometry and Vision Science, University of Waterloo, Waterloo, ON, Canada; 3School of Optometry and Vision Science, University of Waterloo, Waterloo, ON, Canada; 3School of Optometry and Vision Science, University of Waterloo, Waterloo, ON, Canada.

Purpose: Here we investigate the sensitivity and specificity of fluorescence in the detection of amyloid β in human retinas of patients with Alzheimer’s disease (AD). Amyloid β is over expressed in the diseased brain, resulting in a neurotoxic effect. It is an accepted marker of disease, used for diagnosis post-mortem, so its presence in the retina presents an opportunity for a noninvasive diagnostic. We investigated visibility of amyloid β deposits using polarimetry in diseased and non-diseased retinas.

Methods: - Ocular tissues were provided by the Eye Bank of Ontario. Ex vivo retinas were stained with thioflavin S and flat mounted from eyes of those with a diagnosis of AD (n=19) and those with no history of AD (n=18) and excluded those with a diagnosis of glaucoma. Retinas were examined using fluorescence in both transmission and confocal scanning microscopy for amyloid β deposits. A subset of the retinas was examined for polarization properties using a polarimeter on a fluorescence microscope. In diseased retinas (defined by an AD diagnosis and positive fluorescence), we counted the number of fluorescent deposits that also had polarization contrast. In non-diseased retinas we counted the number of locations showing polarization contrast.

Results: Of those retinas that were positive for thioflavin S staining of amyloid β, 72.6% of subjects had a positive AD history (positive predictive value), and of retinas that tested negative, 81.3% of subjects did not have an AD history (negative predictive value). A lower positive predictive value may arise from incomplete medical histories or undiagnosed disease. The negative predictive value may be lower due to the challenging differential diagnoses of dementia. When examined with polarimetry, a generator position giving circularly polarized light and an analyzer sampling the orthogonal circular polarization produced visibility of deposits in 77.4% of locations in diseased retinas with positive fluorescence. 22.6% of retinal locations, positive in polarimetry were false negatives.

Conclusions: Thioflavin S staining in the retina shows an 84.2% sensitivity and 72.2% specificity in detecting AD. The use of crossed circular polarization showed a high specificity to amyloid β deposits but produced some false negatives. This method shows promise for the imaging of amyloid β in the retina of the living eye as a marker of Alzheimer’s disease.

Commercial Relationships: Laura Emptage, None; Marsha L. Kisilak, None; Matthew Wilson, None; Zoya Leonenko, None; Melanie C. Campbell, University of Waterloo (P)
Support: CIHR and NSERC

Program Number: 3367 Poster Board Number: C0060
Presentation Time: 11:00 AM–12:45 PM

Optical properties of the human retina as a window into systemic and brain diseases
Rui Bernardes1, 2, António Correia1, Otília C. d’Almeida1, 3, Sónia Batista1, Lívia Sousa2, Miguel Castelo-Branco2, 3. 1Physics and Astronomy, University of Waterloo, Waterloo, ON, Canada; 2School of Optometry and Vision Science, University of Waterloo, Waterloo, ON, Canada; 3School of Optometry and Vision Science, University of Waterloo, Waterloo, ON, Canada.

Purpose: To demonstrate the sensitivity and specificity of the human retina’s optical properties to multiple sclerosis (MS).

Methods: Our research group has previously established the possibility to statistically classify and identify eyes belonging to diabetic patients from healthy controls, based on the optical properties of the retina.

In the current work, we resort to the same approach, to identify specific changes associated to MS. High-definition optical coherence tomography (HD-OCT, Carl Zeiss Meditec, Dubin, CA, USA) was used to image eyes from patients diagnosed with MS (35 eyes from 19 patients) and eyes from a control group (35 eyes from 22 patients). In addition, we collected OCT scans of diabetic retinopathy (DR) patients (ETDRS levels 10 to 35) from our institutional database (35 eyes from 22 patients). In group selection, age-matching was optimized to prevent the possible influence of ageing factors, as previously demonstrated (MS: 38.4 (6.3); controls: 37.0 (7.5); DR: 48.1 (2.3)) (mean (SD), years).

OCT scans were segmented to obtain the layers between the inner limiting membrane and the retinal pigment epithelium and the probability density function (PDF) of the resulting data was computed. From each PDF, a set of parameters was determined by capturing the shape of the distribution and used as input to a supervised classification process (support vector machine). To improve the performance of the classification, greedy backward elimination and forward selection routines were ran to identify an optimal set of features and a 10-fold cross-validation process was applied to determine system performance.

Results: The classification process between the MS and the control group achieved an accuracy of 95.7% with sensitivity of 100% and specificity of 91.4%.

To further evaluate the specificity of the process, a classification into three groups (MS, controls and DR) was performed. The system achieved an accuracy of 85.7%, demonstrating the specificity of the information embedded in the optical properties of the retina for the healthy status, diabetes (a multifactorial disease) and MS (a central nervous system disorder).

Conclusions: These results make evident the possibility to use the retina as a window into brain diseases and systemic conditions, such as diabetes. Additionally, it proves that the retina’s inherent optical information is biologically specific to each of the conditions tested.

Commercial Relationships: Rui Bernardes, None; António Correia, None; Otília C. d’Almeida, None; Sónia Batista, None; Lívia Sousa, None; Miguel Castelo-Branco, None


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Spectral Domain Optical Coherence Tomography of Ganglion Cell Complex and Retinal Nerve Fiber Layer in Multiple Sclerosis

Silvia Calafiore, Gianluca Scuderi, Francesco Martino, Giorgio Ducoli, Martina Maria Delle Fave, Andrea Perdicchi. NESMOS, Sapienza University of Rome, Rome, Italy.

Purpose: To evaluate the thickness of the macular Ganglion Cell Complex (GCC) and peripapillary Retinal Nerve Fiber Layer (pRNFL) with Spectral Domain Optical Coherence Tomography (SD OCT) in Multiple Sclerosis (MS) patients

Methods: 66 MS consecutive patients, of whom 42 with history of monocular/binocular Optic Neuritis (ON), 24 without ON, and 22 healthy control patients were recruited. Exclusion criteria were: age > 45 yrs, EDSS score >4.5, ON episode in the last 6 months prior to enrollment, refractive error/astigmatism of ≥ 5.00 D, retinal diseases and other optic neuropathy including glaucoma, previous eye surgery and amblyopia. Eyes were written in 4 groups: 44 MS-ON eyes, 40 contralateral non affected MS-ON group eyes, 48 MS-non-ON group eyes, 44 healthy control eyes. GCC and pRNFL measurements were performed by SD-OCT (Optovue). Results were compared using T-Student Test

Results: pRNFL and GCC thicknesses were significantly decreased in MS-ON eyes compared to control group (p<0.0001). Same results were found in MS-ON eyes compared to MS-non-ON eyes (p<0.0001). GCC thickness was considerably decreased in contralateral non affected MS-ON group eyes compared to control group (p=0.0001) whereas pRNFL values were not statistically significant (Temporal p=0.003, Superior p=0.394, Nasal p=0.723, Inferior p=0.034). Contralateral non affected MS-ON group eyes compared to MS-ON eyes were highly decreased in GCC and pRNFL values (p<0.0001). pRNFL thickness was not significantly lower in the MS-non-ON eyes compared to controls (Temporal p=0.210, Superior p=0.376, Nasal p=0.282, Inferior p=0.659), while GCC average thickness was considerable decreased (p=0.0005). GCC was thinner in the Inferior part (p=0.0001) and showed a statistically significant Focal Loss Volume (FLV)

Conclusions: GCC thickness was decreased in MS patients compared to healthy control group, regardless of any previous ON episode. As opposed to GCC, RNFL was reduced only in MS-ON patients. Those results confirmed that retrograde axonal degeneration is always present in MS regardless of symptomatic ON. SD OCT and GCC protocol in particular, could allow a more accurate view in MS research providing understanding of the pathophysiology, detection of occult neuro-degeneration and monitoring of neuroprotective therapies

Commercial Relationships: Silvia Calafiore, None; Gianluca Scuderi, None; Francesco Martino, None; Giorgio Ducoli, None; Martina Maria Delle Fave, None; Andrea Perdicchi, None

Program Number: 3368 Poster Board Number: C0061
Presentation Time: 11:00 AM–12:45 PM

Optical coherence tomography in the diagnosis and management of age-related macular degeneration

Christine M. Schmucker1, Gianni Virgili2, Gerta Ruecker1, Hansjürgen Agostini1, Christoph Ehlken1.
1German Cochrane Center, University Medical Center Freiburg, Freiburg, Germany; 1Department of Ophthalmology, University of Florence, Florence, Italy; 1Department of Medical Biometry and Statistic, University Medical Center Freiburg, Freiburg, Germany; 1University Eye Hospital, University Medical Center Freiburg, Freiburg, Germany.

Purpose: OCT became an essential tool to manage antiVEGF therapy in patients with AMD. We set out a systematic review to evaluate diagnostic test accuracy of OCT in the diagnosis and management of AMD.

Methods: Medline, Embase and the Cochrane Library were searched for clinical studies without restrictions on date. We selected studies that assessed the diagnostic accuracy (sensitivity [SE] and specificity [SP]) of any OCT model for detecting or monitoring of neovascular AMD. Methodological study quality was evaluated after the “Quality of Diagnostic Accuracy Studies” (QUADAS) checklist.

Results: Of 4572 citations reviewed, 9 studies met the inclusion criteria (632 patients, 657 eyes, 880 measurements). CNV was the target condition and fluorescein angiography (FA) the goldstandard in all studies. Prevalence of CNV varied between 14.9% to 83.0% (median 56.9%). Two studies included patients with suspected CNV (205 patients, 218 eyes, 218 measurements): thereby, the SE of OCT for detecting CNV lesions was 69.0% and 96.4%, respectively and SP 66% in both studies (both studies used time-domain OCT). Seven studies evaluated diagnostic accuracy for retreatment decisions (427 patients, 439 eyes, 662 measurements): pooled SE was 86.3% (95% CI 74.4-93.1%) and SP was 50.7% (95% CI 39.9-61.4%). From these 7 studies, 2 studies applied spectral-domain OCT. A subgroup analysis showed no significant difference in both SE and SP between spectral- and time-domain OCT, which can be most likely explained by the low number of included trials. Overall methodological study quality was adequate for most QUADAS items (e.g., most studies were masked, the cut-off for a positive OCT finding was intraretinal and/or subretinal fluid). However, some of the current study data show an “unit of analysis issue” as both eyes or multiple measurements in one eye of one patient were treated in the data analysis as they were independent.

Conclusions: FA remains the most reliable method to detect suspected (or new) CNV. Due to the fact that most published studies are evaluating time-domain OCT, diagnostic accuracy of spectral-domain OCT in comparison to FA still needs to be established. Disagreements between OCT measurements and FA (especially the apparent high false positive rate) may be explained that intraretinal fluid decrease is traceable with OCT but not with FA - at least in monitoring the activity of occult CNV after antiVEGF therapy.

Commercial Relationships: Christine M. Schmucker, None; Gianni Virgili, None; Gerta Ruecker, None; Hansjürgen Agostini, None; Christoph Ehlken, None

Support: German Health Insurance Grant for Diagnostic OCT

Program Number: 3370 Poster Board Number: C0063
Presentation Time: 11:00 AM–12:45 PM

Segmentation Error versus Decentration Error of SDOCT Volume Scans in Eyes with Neovascular Age-related Macular Degeneration

Lisa A. Engel1, Tina Ristau1, Nils F. Mokwa1, Alexander Walsh1, Bernd Kirchhof1, Srinivas R. Sadda2, Sandra Liakopoulos1. 1Center of Ophthalmology, University Hospital of Cologne, Cologne, Germany; 2Doheny Image Reading Center, Doheny Eye Institute, Los Angeles, CA; 3Department of Ophthalmology, Keck School of Medicine of the University of Southern California, Los Angeles, CA.

Purpose: To compare segmentation and decentration errors of SDOCT volume scans in eyes with neovascular age-related macula degeneration (NVAMD) and to analyze the impact of visual acuity, CNV lesion type and SDOCT parameters.

Methods: SDOCTs (Spectralis, Heidelberg Engineering) of 64 eyes of 62 patients with NVAMD were retrospectively collected. Foveal central subfield (FCS) and foveal center point (FCP) thickness
measurements (ILM to Bruch’s membrane) were calculated before and after manual correction of segmentation errors and positioning of the ETDRS grid using computer-assisted manual grading software. Statistical analysis was performed using the Wilcoxon signed-rank test.

**Results:** The mean absolute difference between FCP (FCS) thickness values before and after manual correction of segmentation errors was $63 \pm 97 \mu m$ ($58 \pm 87 \mu m$), which increased to $73 \pm 110 \mu m$ ($65 \pm 100 \mu m$) after additional manual centration of the ETDRS grid on the fovea. Absolute FCP (FCS) difference $>50 \mu m$ was seen in $36\%$ ($31\%$) of cases after correction of segmentation errors, and in $42\%$ ($39\%$) after additional correction of the grid position. Eyes with greater retinal thickness showed larger differences after manual segmentation, eyes with cystoid spaces or absence of SRF showed larger differences after manual centration. There was no impact of CNV lesion type, presence of PED, or visual acuity.

**Conclusions:** Manual grading of SDOCT volume scans improves the quality of thickness measurements not only by correcting segmentation errors but also by adjustment of the grid position. Segmentation error was higher in eyes with greater retinal thickness values. Decentration error was higher in eyes with cystoid spaces or absence of SRF.

**Commercial Relationships:** Lisa A. Engel, None; Tina Ristau, None; Nils F. Mokwa, None; Alexander Walsh, Envision Diagnostics, Inc (E), Envision Diagnostics, Inc (I), Envision Diagnostics, Inc (P); Bernd Kirchhof, None; Srinivas R. Sadda, Carl Zeiss Meditec (C), Carl Zeiss Meditec (F), Optos (C), Optos (F); Sandra Liakopoulos, None

**Program Number:** 3371 Poster Board Number: C0064
**Presentation Time:** 11:00 AM–12:45 PM

**Retinal and choroidal thickness: comparison of two non-contact optical biometers in young adults.**

**Purpose:** to compare the measurements of retinal and choroidal thickness with two non-contact optical biometers.

**Methods:** Retinal and choroidal thickness were measured in right eyes of 32 young adult subjects by means of two non contact optical biometers (Heidelberg Spectralis OCT; Heidelberg Engineering and Lenstar LS900, Haag-Streit). For each subject, the average of 3 OCT measurements and 5 Lenstar measurements was analyzed. Comparison and inter-device agreement were evaluated using paired t-test and Bland-Altman plots.

**Results:** Lenstar measurements were impossible to perform for retinal thickness (RT) in 15% of subjects; however all choroidal thickness (CT) measurements could be taken. The mean RT measured by OCT (213±14 μm) was systematically and significantly higher than when measured with Lenstar (183±20 μm), p=0.001. CT showed similar differences: 273±61 (OCT) μm and 203±38 μm (Lenstar), p=0.05. The mean inter-device differences in RT and CT were 31 μm and 75 μm respectively with 95% limits of agreement of [11 ; 50] μm and [-82 ; 232] μm.

**Conclusions:** Agreement between OCT and Lenstar was poor for both retinal and choroidal thickness measurements. Retinal thickness could not be measured precisely in many subjects with Lenstar. For retinal and choroidal thickness studies, OCT seems to be a more appropriate choice than Lenstar.

**Commercial Relationships:** Bjorn Drobe, Essilor International (F); Jinhua Bao, Essilor International (F); Ke Chen, Essilor International (F); Hao Chen, Essilor International (F)

**Program Number:** 3372 Poster Board Number: C0065
**Presentation Time:** 11:00 AM–12:45 PM

**Abnormalities in Retinal Structure in Diabetics with Minimal or no Retinopathy Assessed by SD-OCT**

**Purpose:** To provide a preliminary evaluation of abnormalities in total retinal thickness (TRT), photoreceptor cell outer segment thickness (OST), and photoreceptor inner segment ellipsoid (ISE) light reflectance in diabetic subjects with minimal or no retinopathy using spectral domain optical coherence tomography (SD-OCT).

**Methods:** SD-OCT imaging of the macula was performed in one eye of 5 diabetic subjects (ages 25 - 64 years) and 5 healthy control subjects (ages 31 - 56 years). Six radial B-scans arranged according to the clock hours and centered on the fovea were obtained using a commercially available instrument (Optos). A customized automated software algorithm (Matlab) was utilized to segment the images and provide metrics of TRT, OST, and the ratio of ISE intensity to retinal pigment epithelium (RPE) intensity (ISE/RPE intensity). Measurements were made using a grid composed of 40 points arranged in four concentric rings (1°, 3°, 6°, and 12° radii) centered at the fovea. The central ring was composed of 4 points and the more peripheral rings were composed of 12 points, arranged according to the clock hours. Measurements within rings were averaged for each subject. To determine the effects of diabetes and retinal eccentricity on these metrics, a two-way analysis of variance was performed. Linear regression analysis was used to describe the relationship between ISE/RPE intensity and OST.

**Results:** TRT and OST were significantly lower in diabetic subjects as compared to controls (p = 0.006 and p < 0.001, respectively). In diabetic and control subjects, OST progressively decreased as retinal eccentricity increased. ISE/RPE intensity was significantly lower in the diabetics, compared to the controls (p = 0.03) and decreased significantly with increasing eccentricity (p = 0.02). A linear relationship between ISE/RPE intensity and OST (R = 0.38, p = 0.016, N = 40) was observed, indicating that reduced ISE light reflectance was associated with OST.

**Conclusions:** In our sample of diabetic subjects with minimal or no retinopathy, structural changes of the retina were observed including reduced total retinal thickness, photoreceptor outer segment thickness, and ISE light reflectance compared to healthy controls. These preliminary results suggest that outer retina abnormalities in diabetic subjects may precede clinically-apparent signs of retinopathy.

**Commercial Relationships:** Andrew W. Francis, J Jason McAnany, Justin Wanek, Jason C. Park, Jennifer I. Lim, Mahnaz Shahidi, None

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**Program Number:** 3373 Poster Board Number: C0066
**Presentation Time:** 11:00 AM–12:45 PM

**Identifying progression of retinal disease in eyes with mild NPDR in diabetes type 2 using non-invasive procedures**

**Purpose:** To determine the effects of diabetes and retinal eccentricity on these metrics, a two-way analysis of variance was performed. Linear regression analysis was used to describe the relationship between ISE/RPE intensity and OST.

**Results:** TRT and OST were significantly lower in diabetic subjects as compared to controls (p = 0.006 and p < 0.001, respectively). In diabetic and control subjects, OST progressively decreased as retinal eccentricity increased. ISE/RPE intensity was significantly lower in the diabetics, compared to the controls (p = 0.03) and decreased significantly with increasing eccentricity (p = 0.02). A linear relationship between ISE/RPE intensity and OST (R = 0.38, p = 0.016, N = 40) was observed, indicating that reduced ISE light reflectance was associated with OST.

**Conclusions:** In our sample of diabetic subjects with minimal or no retinopathy, structural changes of the retina were observed including reduced total retinal thickness, photoreceptor outer segment thickness, and ISE light reflectance compared to healthy controls. These preliminary results suggest that outer retina abnormalities in diabetic subjects may precede clinically-apparent signs of retinopathy.

**Commercial Relationships:** Andrew W. Francis, None; J Jason McAnany, None; Justin Wanek, None; Jason C. Park, None; Jennifer I. Lim, None; Mahnaz Shahidi, None

**Support:** NIH research grant R00EY019510 (JM), R01EY017918 (MS), NIH core grant P30EY001792, and an unrestricted departmental grant from Research to Prevent Blindness.
Purpose: To identify eyes of patients with diabetes type 2 that show progression of retinal disease within a one-year period of follow-up using non-invasive techniques.

Methods: Three hundred seventy four (374) type-2 diabetic patients with mild nonproliferative diabetic retinopathy (NPDR) (ETDRS levels 20 or 35) were included in a 12-month observational and prospective study to identify retinopathy progression. Patients were included in 19 clinical sites from the European Vision Institute Clinical Research Network (EVICR.net). Four visits were scheduled at months 0, 3, 6 and 12 with the following examinations: color fundus photography (CFP), spectral domain optical coherence tomography (SD-OCT) and blood tests. ETDRS severity level in the first and last visits, and microaneurysm (MA) turnover (formation plus disappearance rates), using the RetmarkerDR, were assessed centrally by the Coimbra Ophthalmology Reading Center (CORC). SD-OCT was used to measure retinal thickness (RT) and ganglion cells layer thickness. One eye per patient was selected as the Study Eye.

Results: 374 patients/eyes with mild NPDR were included (65.0% males and 35.0% females) with ages ranging from 35 to 82 years (18.4% graded as level 20 and 81.6% as level 35, ETDRS severity scale). Mean BCVA was 84.9±6.3 ETDRS letters. Mean HbA1C was 7.8±1.5% and the systolic and diastolic blood pressure was respectively of 137.6±16.6 and 77.4±10.0 mmHg.

328 eyes/patients completed the study (325 completed the 12-month visit and 3 eyes developed CSME between the 6 and 12-month visits).

The mean central RT at baseline was 264.9±21.9 μm (Cirrus SD-OCT). At the 6-month visit (336 eyes/patients), 18 eyes (5.4%) showed a central subfield RT decrease of 5% or more, whereas 30 eyes (9.9%) showed a central subfield RT increase higher than 5%. In the period of 12-months of follow-up, a MA turnover equal or higher than 6 was registered in 45.5% of the eyes, whereas 54.5% of the eyes showed MA turnover values of less than 6.

Conclusions: MA turnover using the RetmarkerDR on field 2 CFP images and central subfield RT changes using SD-OCT over a 12-month period of follow-up in eyes with mild NPDR, identify activity and progression of the retinal disease. Different eyes/patients with diabetes type 2 and mild NPDR show different involvement of the different components of the retinal neurovascular unit.

Commercial Relationships: Catarina Neves, None

Clinical Trial: NCT01145599

Program Number: 3374 Poster Board Number: C0067

Presentation Time: 11:00 AM–12:45 PM

Subclinical macular OCT changes in type 1 diabetic patients

Kacy Richmond, Elliot S. Crane, Ben Szirth, Albert S. Khouari, Saysha Blaier. Institute of Ophthalmology and Visual Science, Rutgers New Jersey Medical School, Newark, NJ.

Purpose: To assess the relationship between spectral domain optical coherence tomography (OCT) macular retinal thickness as a function of age and duration of disease in children with type 1 diabetes mellitus (DMI).

Methods: 91 subjects (182 eyes) were screened at an international conference for children with diabetes mellitus type 1 in Orlando, FL. Age of individuals screened ranged from 2 to 30 yr with a mean of 14.95 and median of 15 yr. Duration of DMI extended from 0.06 to 26 yr, with a mean of 8.12 and median of 7 yr. The average A1C for these individuals was 7.7%. Caucasians represented 89% of eyes screened. A comprehensive screening was performed including non-mydriatic fundus imaging (Canon, CR2 Plus-AF with EOS-60D) and SD-OCT (Optovue, iVue). OCT scans were acquired showing macular thickness (MT), ganglion cell complex (GCC) thickness, and thickness of the perimacular region in all four quadrants 2-4 and 4-6 mm from the fovea. Using simple linear regressions, macular, perimacular and GCC thickness were analyzed as a function of age and duration with DMI.

Results: Prior to clinical manifestations of diabetic retinopathy (DR), superior perimacular and macular changes may be detected by SD-OCT. Of 182 eyes screened, just 2 eyes showed mild non-proliferative DR. The remaining 180 eyes had no clinical signs of DR. Macular thickness increased as a function of age (p=0.01 OD; p=0.001 OS). Trends representing thinning in all perimacular regions as a function of duration of DMI were observed, though only the superior perimacular region showed statistical significance. The thickness of the superior perimacular region (2-4 and 4-6 mm from fovea) decreased as a function of duration of DMI (p=0.024 and 0.022 OD; p=0.058 and 0.026 OS) (Fig 1). No significant trends were observed for GCC. See table for mean and standard deviation values of macular thickness, superior and inferior perimacular region (2-4; 4-6) thickness, and GCC thickness for OD and OS.

Conclusions: In this cohort of young DMI patients macular changes were detected prior to any fundus changes consistent with diabetic retinopathy. These findings highlight the importance of using SD-OCT to detect and follow ocular changes in DMI patients. This warrants a larger study with comparison to a normal reference database.

Fig. 1: Sup. perimacular thickness (μm) plotted by regions 2-4 & 4-6mm from fovea against duration of DMI (years).
Purpose: Newer optical coherence tomography (OCT) devices that incorporate spectral domain (SD) technology are replacing time domain instruments. This study was performed to calculate measurement variability and relationships between retinal thickness (RT) measurements obtained on different instruments. These data are critical for proper use of RT measurements in clinical trials and clinical settings.

Methods: A cross-sectional observational study was performed on diabetics with at least one eye having center-involved diabetic macular edema, defined as Stratus central subfield thickness (CST) >250 μm, by centers in DRCR.net. We evaluated the reproducibility of RT measurements from OCT images obtained with Zeiss Stratus and Optovue RTVue and formulated equations to convert RT measurements from RTVue to “equivalent” Stratus values. Each study eye underwent two replicate Stratus scans followed by two replicate RTVue scans centered on the fovea.

Results: The Bland-Altman coefficient of repeatability for relative change in CST was not significantly different on Stratus and RTVue scans (10% and 16%, respectively). Replicate Stratus CST was within 10% of the initial Stratus CST 93% of the time; the CST conversion equation predicted a Stratus value calculated from the observed RTVue value within 10% of the observed Stratus thickness 91% of the time. The Bland-Altman limits of agreement for relative change in CST were visible on both scanning devices in all patients. Mean CRT showed significant correlation with visual acuity (Pearson correlation, r= -0.76 and -0.66, both P<0.001). With a minimal difference, the highest correlation was seen between Spectralis and visual acuity. Differences in acquisition and segmentation algorithms associated with visual acuity in patients with diabetic macular edema by comparing two commercially available spectral domain (SD)-OCT instruments.

Conclusions: Differences in acquisition and segmentation algorithms of two SD-OCT devices may affect CRT values in patients with diabetic macular edema. However, sensitivity and specificity of both OCT devices in diabetic macular edema were studied. The patients had a mean age of 51 years and average logMAR visual acuity of 0.54. Outer retina abnormalities were visible on both scanning devices in all patients. Mean CRT was 362.38 um in Cirrus and 387.82 um in Spectralis. ORI defects showed significant correlation with visual acuity (Pearson correlation, r= -0.76 and -0.66, both P<0.001). With a minimal difference, the highest correlation was seen between Spectralis and visual acuity.

Commercial Relationships: Veronica A. Kon Jara, none; Benjamin Buck, none; Gabriela Lopezcarasa, none; Maurice Landers, none.

Support: Research to Prevent Blindness.

Program Number: 3377 Poster Board Number: C0070
Presentation Time: 11:00 AM–12:45 PM

Quantitative image analysis applied to the grading of vitreous haze

Brian Madow, Erin Greenberg, David W. Richards, Christopher L. Passaglia.

Ophthalmology, University of South Florida, Tampa, FL; Chemical & Biomedical Engineering, College of Engineering, USF, Tampa, FL.

Means and standard deviations for selected variables.

<table>
<thead>
<tr>
<th>Variable</th>
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<th>Std. Dev</th>
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<td>Macular Thickness OS</td>
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**Purpose:** To develop a quantitative method for grading the “bluriness” of ocular fundus images in order to permit automated grading of the severity of vitritis.

**Methods:** Several different image processing algorithms were written on the Matlab platform to quantify blurinness, which included Fourier spatial-frequency analysis, wavelet transforms, and entropy filtering methods. The algorithms were refined and validated using a set of 8 reference images that were acquired by masking a single “standard” fundus picture with a series of analog spatial filters. After reference set validation, the algorithms were applied without modification to a dataset of clinical images. The dataset consisted of 12 TIFF digital fundus images of 12 eyes of 12 patients with uveitis. Computer-scored results were then compared in a masked fashion with the subjective readings of an expert clinician (BM).

**Results:** Spatial frequency, wavelet transform, and entropy filtering algorithms by themselves all performed well for the reference set, giving scores that scaled in proportion to the known blur factor, but much less so for the clinical set owing to the large inherent variation among patients and image takers. Better overall performance was achieved with an algorithm that combined spatial frequency and entropy filtering. The Pearson correlation coefficient between the mixed-method scores and physician grades of blurliness was 0.81 (R² = 0.66) for the clinical dataset.

**Conclusions:** We have developed a computer algorithm for grading vitreous haze in an unbiased and quantitative manner that correlates strongly with subjective readings of an expert clinician. We aim to now expand these findings to larger sets of fundus images and larger pools of experts.

**Commercial Relationships:** Brian Madow, None; Erin Greenberg, None; David W. Richards, None; Christopher L. Passaglia, None

**Program Number:** 3378 Poster Board Number: C0071

**Presentation Time:** 11:00 AM–12:45 PM

**Correlation between visual acuity and morphologic subtypes of diabetic macular edema based on a new clinical grading protocol (SAVE)**

**Matthias Bolz, Josef Pretzl, Nicole Klaida, Siegfried Priglinger.**

Department of Ophthalmology, General Hospital Linz, Linz, Austria.

**Purpose:** A new grading protocol for diabetic macular edema (DME) was presented previously based on optical coherence tomography (OCT) and fluorescence angiography (FA). Aim of this study was to correlate visual acuity to several different subtypes of DME based on this grading protocol.

**Methods:** 71 eyes of 50 patients with clinically significant DME were examined with macular map OCT scans and fluorescence angiography using Spectralis HRA and OCT (Heidelberg Engineering©). Visual acuity was performed according to the ETDRS protocol (early treatment of diabetic retinopathy study) on the same day. All imaging data was evaluated by 2 readers according to a grading protocol abbreviated “SAVE” that was previously presented, whereas “S” stands for “subretinal fluid”, “A” for “area” (planimetric dimension), “V” for “vitreo-retinal abnormalities” and “E” for edema type (focal, non-focal, ischemic, degenerative). The aim of the grading protocol is to describe all categories by numbers followed by the central millimetre retinal thickness in μm (e.g. S0A5V1E2 537). All imaging and functional test results were correlated.

**Results:** There was a good inter-grader agreement regarding the graded categories of the SAVE grading protocol. Subretinal fluid did not show a significant correlation with visual acuity, nor did edema expansion (category A). However, there was a correlation between the edema subtype (category E) and visual acuity. Visual acuity was significantly better in patients with edema type 1 (focal edema) than in type 3 (ischemic) or 4 (degenerative). The significance of the correlation between visual acuity and central retinal thickness depended on the morphologic sub-type.

**Conclusions:** Apart from describing the individual type and amount of alteration of DME, the SAVE grading protocol based on OCT and FA images reveals the correlation between retinal morphology and function. These findings are relevant not only for diagnosis in daily clinical routine, but also for treatment decisions and the definition of inclusion criteria in clinical trials.

**Commercial Relationships:** Matthias Bolz, None; Josef Pretzl, None; Nicole Klaida, None; Siegfried Priglinger, None

**Program Number:** 3379 Poster Board Number: C0072

**Presentation Time:** 11:00 AM–12:45 PM

**Optical Coherence Tomography of the Central Retina in Pediatric Patients with Usher Syndrome**

**Vincenza Mucaj¹, Emily A. Swanson¹, Jena Tavormina¹, Ronald M. Hansen²,³, Anne Moskowitz²,³, James D. Akula¹,², Anne Fulton¹,².**

¹Ophthalmology, Boston Children, Boston, MA; ²Harvard Medical School, Boston, MA.

**Purpose:** Cystoid macular edema (CME) is a complication of retinal degenerations often found in patients with Usher syndrome. We used optical coherence tomographs (OCTs) to evaluate macular structure in pediatric patients with a genetic diagnosis of Usher syndrome, a recessively inherited condition characterized by hearing loss and retinal degeneration.

**Methods:** Spectral-domain OCTs centered on the fovea and spanning 20° horizontally were recorded from seven patients with Usher syndrome (median age 13 years) and compared to those from 10 healthy control subjects. Three of the Usher syndrome patients had a clinical diagnosis of CME. The depth and breadth of the foveal pit, the thickness of the retinal laminae, and total retinal thickness were measured using ImageJ in scans containing at least 49 frames in which all retinal layers were clearly visible. ANOVA was used to compare retinal thickness as a function of eccentricity (center, temporal rim, and nasal rim of the foveal pit).

**Results:** There was no significant difference between Usher patients and controls in the depth of the foveal pit (median135 μ, range 63 to 149 μ; median125 μ, range 75 to 149 μ, respectively) or in the breadth of the foveal pit (median 1.1°, range 0.9° to 1.8°; median 1.0° range 0.9° to 1.4°, respectively). Total retinal thickness and ONL thickness were less in Usher patients than in controls. Of note, these thicknesses were significantly more variable among Usher patients than controls, including those who did NOT have a clinical diagnosis of CME. Total retinal thickness varied significantly with eccentricity in both controls (as expected) and in these young patients with Usher syndrome. Interestingly, there was a significant interaction of group (Usher, control) and eccentricity.

**Conclusions:** Among the patients with Usher syndrome, the combination of thinner mean total retinal and OPL thickness and significantly greater variability in these thicknesses may be due to a range of severity of photoreceptor disease, subclinical CME, or both.

**Commercial Relationships:** Vincenza Mucaj, None; Emily A. Swanson, None; Jena Tavormina, None; Ronald M. Hansen, None; Anne Moskowitz, None; James D. Akula, None; Anne Fulton, None

**Support:** NIH Grant EY010597
Purpose: Photoreceptor loss is characteristic of RP. Traditional visual function measures have limited sensitivity at quantifying this process, at least over the short term, which impacts initiation of clinical treatment trials. Birch et al. (JAMA Ophthalmol. 2013 Sep;131(9):1143-50) reported that the perifoveal ellipsoid zone (IS/OS boundary), which is measurable with repeatability and precision, may be a useful outcome measure for prospective RP trials. The purpose of this study was to assess the utility of EZ area in an ongoing clinical trial by correlation with visual field (VF).

Methods: Both eyes of 24 participants in the ongoing “Trial of Oral Valproic Acid for Retinitis Pigmentosa” (VPA, NCT01233609), for whom baseline and end-of-study (week 52) SD-OCTs were available, were studied. All analyses were conducted masked to treatment assignment. GCP-compliant semi-automated EZ area measurement protocols were developed. Full-field static perimetric VF studies (164 loci, GATEi test strategy, target size V, performed in replicate) from these same patients, that passed quality assessment, were included in the analyses. Correlations at the baseline visit and changes over 12 months were estimated between EZ area and a variety of volumetric visual field parameters including total hill of vision, central 30° hill of vision, and sensitivity loss in decibels below normal.

Results: The EZ area could be measured at baseline in ~50% of VPA cases. Exclusions were mostly because the EZ extended beyond the area scanned. The correlation of EZ area between eyes was high (mean=2.6mm², rs=0.96, p<0.001). At baseline, the size of the EZ area fit best, on average, with a 4-5 dB sensitivity loss in visual fields, as compared to normals.

Conclusions: Although our results are preliminary, the EZ area is correlated with the hill of vision. Our future plans in developing this potential outcome variable are to conduct prospective evaluation of the EZ area and hill of vision change and to explore OCT protocols that capture larger EZ areas in earlier stage disease.

Commercial Relationships: Alexander Ho, None; Travis Smith, None; Amirhossein Haririi, None; Elvira Chegarnov, None; Frederick L. Ferris, None; Paul Van Veldhuisen, None; Srinivas R. Sadda, Carl Zeiss Meditec (C), Carl Zeiss Meditec (F), Optos PLC (C), Optos PLC (F); Richard G. Weleber, Foundation Fighting Blindness (S), PCT/US2009/062427 (P); David G. Birch, None

Support: Foundation Fighting Blindness Clinical Research Institute; Research to Prevent Blindness

Clinical Trial: NCT01233609
Methods: Patients were children (17 months to 12 years age) with isolated PAX6-associated aniridia (3 patients confirmed by PAX6 gene testing; 1 with PAX6 mutation presumed on the basis of dominant inheritance). Images of the fovea and optic nerves were obtained using SD-OCT (Spectralis, Heidelberg Engineering) utilizing automated eye tracking. In two patients, sectoral retinal nerve fiber layer (RNFL) thickness was determined using the Spectralis circular RNFL scan centered on the optic disc. In the remaining 2 subjects, RNFL thickness was determined manually from line scans owing to nystagmus. In the latter 2 cases, distances from the optic nerve center were corrected for refractive error and results were plotted with the normative RNFL data. RNFL data from 5 children with ONH were used as a comparison. The diameter of the optic canal (distance between Bruch’s membrane) was estimated by horizontal line scans through the middle of the optic nerve.

Results: All aniridics had anatomical deficiencies of the central iris, foveal hypoplasia without an anatomical pit, and nystagmus. None of the aniridics had glaucoma. There were global losses of the nerve fiber layer within the maculopapular bundle as well as the remaining quadrants (microns below norms, temporal = 29, superior = 25, nasal = 24, inferior = 48). Overall, RNFL thickness was similar between subjects with aniridia and ONH at all quadrants. The optic canals ranged from 1360 to 1700 microns in aniridia whereas the range was 740 to 1274 microns in ONH.

Conclusions: We show RNFL thickness in the maculopapular bundle is decreased in aniridia, which is expected from isolated foveal hypoplasia. However, there is a reduction across all RNFL quadrants, particularly the infero-nasal quadrant. The optic canal diameter is normal in this subset of patients but is small in ONH, suggesting that, in a subset of patients, the pathogenic mechanisms underlying hypoplasia of the RNFL in aniridia and ONH are different.

Commercial Relationships: Rebecca Lindsay, None; John P. Kelly, None; Avery H. Weiss, None

Program Number: 3383 Poster Board Number: C0076
Presentation Time: 11:00 AM–12:45 PM

Structural Findings in Carriers and Affected Individuals with Choroideremia – an Optical Coherence Tomography Study

Daniel C. Chung, Jessica I. Morgan, Emily S. Charlson, Jean Bennett, Albert M. Maguire. FM Kirby Ctr Molecular Ophth, Scheie Eye Institute, Philadelphia, PA.

Purpose: To describe retinal structure in carriers and affected individuals with choroideremia, as evaluated by spectral domain optical coherence tomography (SD-OCT) in a prospective, case series study.

Methods: SD-OCT evaluations using the HRA-OCT Heidelberg Spectralis were performed on 10 carriers and 31 affected subjects. Prevalence, location and area of hyporeflective (HR) areas, outer retinal tubulations (ORT), retinal pigment epithelial (RPE) and retinal atrophy, schisis-like formations and other anomalies were noted. Retinal segmentation and thickness measurements were also obtained.

Results: Among affected individuals, bilateral HR areas were found in 8 of 31 CHM patients. 4 of 31 patients had unilateral HR areas. Overall 12 of 31 patients were observed to have HR areas. The HR areas theoretically could be infraretinal fluid, swollen degenerating cells or other structural anomalies in the degenerating retina. Additionally, 15 of the affected patients had ORT, RPE mottling, atrophy or schisis-like formations. Also noted were discrete regions of intact retinal laminations that were horizontally adjacent to regions of significant retinal degeneration. In transition zones between relatively intact retina and degenerating retina, remnants of outer nuclear layer (ONL) could persist without an underlying RPE, as well as the reverse. Total retinal and ONL thickness decreased with age in CHM patients, with the central region maintaining retinal and ONL thickness and structural laminations the longest. Carriers exhibited decreased levels of ONL thickness overall, but generally maintained retinal lamination. Three of the 10 carriers also exhibited RPE changes and ORT.

Conclusions: The prevalence of bilateral HR areas in CHM subjects was 25.8% (8/31), unilateral in 12.9% (4/31) and 32.9% in all CHM cases (12/31). HR areas, ORT, atrophy and schisis-like formations were relatively common characteristics seen on SD-OCT in CHM patients. The sequential degeneration of RPE vs ONL may be variable, as both scenarios were evident. CHM carriers have some degree of structural retinal degeneration as evidenced by decreased ONL thickness and the presence of ORT. SD-OCT real-time structure imaging could help determine the sequence of retinal layer degeneration, with potential implications in illustrating disease progression and prognosis.

Commercial Relationships: Daniel C. Chung, None; Jessica I. Morgan, Canon Inc. (C), Canon Inc. (F), Canon Inc. (R), Optos, PLC (F); Emily S. Charlson, None; Jean Bennett, None; Albert M. Maguire, None

Support: NIH EY019861, the Foundation Fighting Blindness, the Choroideremia Research Foundation, Research to Prevent Blindness, the F. M. Kirby Foundation, the Paul and Evanina Mackall Foundation Trust, the Institute for Translational Medicine and Therapeutics of the University of Pennsylvania (Grant UL1RR024134 from the National Center for Research Resources) Hope for Vision Foundation

Program Number: 3384 Poster Board Number: C0077
Presentation Time: 11:00 AM–12:45 PM
En Face OCT Imaging of Retinal Astrocytic Hamartoma in 13 cases

Eleonora Benedetta Marcheggiani1, Chiara Veronese2, Lara Enrica Urbini3, Filippo Tassi1, Alessandro Finzi1, Mariachiara Morara2, Antonio P. Ciardella1. 1Ophthalmology Unit, University of Bologna, S. Orsola-Malpighi Hospital, Bologna, Italy; 2Ophthalmology Unit, S. Orsola-Malpighi Hospital, Bologna, Italy.

Purpose: To describe the features of retinal astrocytic hamartoma using En face spectral domain optical coherence tomography (SD-OCT) imaging.

Methods: En face SD-OCT imaging was performed in 12 patients (13 eyes) and tibersous sclerosis was present in all patients (100%). Systematic work-up included retinal examination by SD-OCT (Spectralis Heidelberg Engineering, Heidelberg, Germany) with OCT B-scans and macular mapping. This mapping consisted of 197 transverse sections in a 5.79x5.79 mm2 central retinal area space of 30 μ. Tridimensional reconstruction generated by the pooling of these sections provided a virtual macular brick, trough which 496 shifting sections in the coronal plane resulted in C-scan, or En face OCT, while B-scan is derived from sagittal and transverse sections.

Results: The mean patient age was 28 years, 6 females (50%) and 6 males (50%). The tumor was classified as flat and sessile in 2 cases (15%), semitranslucent and partially calcified in 8 (61%), having a complete multilayerlike calcification in 1 (8%), 1 cavitory (8%) and 1 exudative complicated hamartoma (8%). The mean tumor thickness and basal dimension by B-scan SD-OCT were respectively 813 μm (median 894; range 389-1310) and 1557 μm (median 1717; range 281-3095). The mean coronal section surface by C-scan was 2,70 mm2 (median 2,85; range 0,30-6,04).

By OCT, the tumor showed some degree of retinal disorganization in all 13 cases (100%). The disorganization was limited to the inner retina in 12 (92%), outer retina in 0 (0%) and full retina with no view...
of deeper layers due to shadowing in 1 (8%). There was gradual transition from a normal retinal to tumor in 12 cases (92%). There was mild retinal traction on the surface of the tumor in 4 (31%), internal mouth eaten optically empty spaces representing intratumoral cavities in 8 (61%) and optical shadowing posterior to the tumor in 3 (23%). Other retinal findings included exudates and macular edema in 1 case (8%).

**Conclusions:** En face OCT imaging gives the advantage of obtaining novel slice orientations. These OCT findings correlate with histopathologic findings, as this tumor typically is composed of randomly oriented elongated fibrous astrocytes with interlacing cytoplasmic processes, which replace the normal retinal microarchitecture. En face OCT is useful in further characterizing the in vivo internal qualities of retinal tumors.

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**Cavitary astrocytic hamartoma**

**Commercial Relationships:** Eleonora Benedetta Marcheggiani, None; Chiara Veronese, None; Lara Enrica Urbini, None; Filippo Tassi, None; Alessandro Finzi, None; Mariachiara Morara, None; Antonio P. Ciardella, None

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**Program Number:** 3385  
**Poster Board Number:** C0078  
**Presentation Time:** 11:00 AM–12:45 PM  
**Spectral Domain Optical Coherence Tomography and Fundus Autofluorescence in Patients with Rubella Retinopathy**  
**Chad Hummel, Sandeep Grover:** Ophthalmology, University of Florida College of Medicine - Jacksonville, Jacksonville, FL.

**Purpose:** Patients with rubella retinopathy clinically show a “salt and pepper” appearance on fundus exam. Typically, these patients do not show any functional impairment of retinal function. This is proposed to be due to changes in the retinal pigment epithelium (RPE). Fundus autofluorescence is an effective method of imaging changes in the RPE. This case series describes the spectral domain optical coherence tomography (SD-OCT) and fundus autofluorescence (FAF) findings in patients with rubella retinopathy.

**Methods:** This is a retrospective chart review and three patients with known diagnosis of rubella retinopathy were identified. All these patients had documented normal visual function and SD-OCT and FAF had been performed. The SD-OCT and FAF records were reviewed and visual acuity and central subfield thickness on SD-OCT were documented. The FAF was studied and a qualitative assessment was made.

**Results:** Clinically, 2 out of 3 patients had bilateral rubella retinopathy while 1 patient had unilateral retinopathy, based on the presence of “salt and pepper” changes on fundus photograph. The visual acuity was normal in all these patients. The macular thickness and structure of the retina, including the photoreceptors and RPE was normal in all eyes of all patients. FAF showed areas of 'patchy autofluorescence' with a stippled hypoautofluorescence on FAF corresponding to the areas of hyperpigmentation on clinical exam. It was interesting that in the patient who had rubella retinopathy in one eye, it was doubtful on clinical exam whether she truly had unilateral retinopathy or bilateral asymmetrical retinopathy. The FAF confirmed that it was truly unilateral with the clinically normal-looking eye showing a normal autofluorescence.

**Conclusions:** SD-OCT and FAF are useful diagnostic tools that effectively illustrate the retinal pigment epithelium changes seen in patients with rubella retinopathy and can help in clinical scenarios.
Purpose: The aim is to in vivo determine the impact of central retinal artery occlusion (CRAO) on the neurosensory retinal layers. Most patients with CRAO present with painless profound visual loss. Histopathologically the acute ischaemia leads to a localized infarction of the inner two thirds of neurosensory retina supplied by the intrinsic retinal vessels. Spectral-domain optical coherence tomography (SD-OCT) allows to characterise these dynamic alterations of retinal ischaemia in vivo.

Methods: We analysed cross-sectionally 15 patients (10 female and 5 male, mean age 76.4±8.7 years) at day 1, 2, 4, 5, 6, 7, 10, 20, 23, 38 and 53 after onset of symptomatic CRAO. The examination included visual acuity, slit-lamp biomicroscopy, fundoscopy and fluorescein angiography. The total retinal thickness (TRT) was measured at the nasal edge of the fovea at the horizontal foveal scan on SD-OCT. The retinal nerve fibre layer (NFL), ganglion cell and inner plexiform layer complex (GCL/IPL), the inner nuclear layer (INL), outer plexiform layer (OPL), outer nuclear layer (ONL) and retinal pigment epithelium complex (RPE) were manually determined and measured by the application software. The healthy contralateral eyes served as controls.

Results: Mean TRT was increased (474±137μm) compared to controls (347±14μm). TRT and the inner retinal layers showed increased thickness values in the acute phase measured at day 1 to 20 (TRT), respectively 6 (RNFL, GCL/IPL), which decreased thereafter in contrast to the controls eyes. INL remained considerably thickened (68±23μm) compared to controls (36±8μm), while thickness of OPL (37±32), ONL (110±18μm) and RPE (67±19) were moderately raised compared to respective control layers (32±6μm, 99±11, 58±9).

Conclusions: SD-OCT provides an in vivo view of dynamic retinal alteration following retinal artery obstruction and helps to understand the pathophysiology in retinal ischaemia.

Commercial Relationships: Silja Bairov, None; Philipp Ackermann, None; Maike Brachert, None; David Finis, None; Philipp Albrecht, None; Gerd Geerling, None; Orhan Aktas, None; Rainer Guthoff, None

Program Number: 3387 Poster Board Number: C0080
Presentation Time: 11:00 AM–12:45 PM

Extension of alteration of retinal neurosensory layers in central retinal artery occlusion
Silja Bairov1, Philipp Ackermann1, Maike Brachert1, David Finis1, Philipp Albrecht2, Gerd Geerling2, Orhan Aktas2, Rainer Guthoff1,
1Ophthalmology, Heinrich-Heine University Düsseldorf, Düsseldorf, Germany; 2Neurology, Heinrich-Heine-Universität, Düsseldorf, Germany.

Extension of alteration of retinal neurosensory layers in central retinal artery occlusion (CRAO) on the neurosensory retinal layers. Most patients with CRAO present with painless profound visual loss. Histopathologically the acute ischaemia leads to a localized infarction of the inner two thirds of neurosensory retina supplied by the intrinsic retinal vessels. Spectral-domain optical coherence tomography (SD-OCT) allows to characterise these dynamic alterations of retinal ischaemia in vivo.

Methods: We analysed cross-sectionally 15 patients (10 female and 5 male, mean age 76.4±8.7 years) at day 1, 2, 4, 5, 6, 7, 10, 20, 23, 38 and 53 after onset of symptomatic CRAO. The examination included visual acuity, slit-lamp biomicroscopy, fundoscopy and fluorescein angiography. The total retinal thickness (TRT) was measured at the nasal edge of the fovea at the horizontal foveal scan on SD-OCT. The retinal nerve fibre layer (NFL), ganglion cell and inner plexiform layer complex (GCL/IPL), the inner nuclear layer (INL), outer plexiform layer (OPL), outer nuclear layer (ONL) and retinal pigment epithelium complex (RPE) were manually determined and measured by the application software. The healthy contralateral eyes served as controls.

Results: Mean TRT was increased (474±137μm) compared to controls (347±14μm). TRT and the inner retinal layers showed increased thickness values in the acute phase measured at day 1 to 20 (TRT), respectively 6 (RNFL, GCL/IPL), which decreased thereafter in contrast to the controls eyes. INL remained considerably thickened (68±23μm) compared to controls (36±8μm), while thickness of OPL (37±32), ONL (110±18μm) and RPE (67±19) were moderately raised compared to respective control layers (32±6μm, 99±11, 58±9).

Conclusions: SD-OCT provides an in vivo view of dynamic retinal alteration following retinal artery obstruction and helps to understand the pathophysiology in retinal ischaemia.

Commercial Relationships: Silja Bairov, None; Philipp Ackermann, None; Maike Brachert, None; David Finis, None; Philipp Albrecht, None; Gerd Geerling, None; Orhan Aktas, None; Rainer Guthoff, None

Program Number: 3388 Poster Board Number: C0081
Presentation Time: 11:00 AM–12:45 PM

A transient additional band in SD-OCT observed in acute retinal ischemic conditions

Purpose: To investigate alterations in the neurosensory retinal morphology secondary to acute retinal ischemic conditions. The observations were documented by spectral domain optical coherence tomography (SD-OCT) and fundus autofluorescence (FAF) imaging.

Methods: SD-OCT images and FAF were used to observe the retinal structure. 26 subjects (36 – 96 years) with acute monocular visual impairment due to retinal ischemia were included. The main focus of attention was set on the transition of the outer nuclear layer (ONL) to outer plexiform layer (OPL). SD-OCT images were acquired with a combined SD-OCT and scanning laser ophthalmoscope (SLO) imaging system using a linear cross hair scan and a 6 line radial scan of 6 mm length (ART mode on; average of 20 frames)
Results: SD-OCT revealed an additional highly reflective band located within the OPL. Morphological characteristics of this hyperdense band were a decreasing intensity with distance from the fovea, partially segmental occurrence and manifestation limited in time. FAF showed areas of increased and decreased signal intensity within the vessel arcade at the posterior pole. The regions of decreased FAF corresponded to perivenous regions and resemble the “frosted branches” sign seen in fluorescein angiography in patients with ocular ischemia.

Conclusions: The additional hyperreflective band observed in SD-OCT could represent a marker for retinal ischemia in subjects without the presence of a complete arterial occlusion. The mid retinal localization of the band within the OPL represents the locus of transition from retinal to choroidal oxygen supply where oxygen diffusion is weakest. Histopathologically the observed structure could represent activated microglial tissue induced by the hypoxia driven upregulation of inflammatory molecules aimed at ischemia repair.

Commercial Relationships: Nikolaus Feucht, Bayer (F), Heidelberg Engineering (C), NovaStim (F), Felix Heine, None; Chris Lohmann, None; Mathias M. Maier, None; Ines M. Lanzl, None.

Program Number: 3389 Poster Board Number: C0083
Presentation Time: 11:00 AM–12:45 PM
The Prognostic Role of Microcystic Macular Changes in Patients with Retinal Vein Occlusions Treated with Ranibizumab
Matus Rehak, Maria Tsui, Peter M. Wiedemann. Department of Ophthalmology, University of Leipzig, Leipzig, Germany.

Purpose: To evaluate the role of microcystic macular changes as prognostic factors for the recurrence of macular edema (ME) in patients with retinal vein occlusion (RVO) treated with ranibizumab.

Methods: We performed a retrospective chart analysis of 78 consecutive patients treated with intravitreal injection of ranibizumab for ME secondary to RVO at the Department of Ophthalmology of University Leipzig. At baseline and monthly follow-up visits over 12 months after first intravitreal injection a comprehensive ophthalmologic examination including best corrected visual acuity (BCVA) measured with ETDRS charts and volume scan of macula performed with spectral domain OCT were done. In patients who received at least 3 initial injections and ME resolved (central retinal thickness; CRT<250μm) the prevalence of microcystic macular changes was evaluated. Further, the changes of BCVA and CRT were analysed at all single time points and compared with baseline.

Results: In total 102 events in 51 patients the presence of macular microcystic changes without worsening of BCVA were detected by OCT during the analyzed follow-up time. In 99 of 102 events (97%) a significant worsening of BCVA and CRT (p<0.0001) within next 4-10 weeks was observed. In mean, the significant increase of CRT and decrease of BCVA occurred 7.1 weeks after the first presence of macular microcysts. In the BRVO group BCVA decreased significantly from 0.31±0.21 logMar at visit with the first detection of microcystic changes to 0.44±0.27 logMar at follow-up visit with the increase of ME. In the CRVO group BCVA decreased from 0.42±0.31 to 0.62±0.29 LogMar. CRT significantly increased from 242.9±37.6 μm to 502.7±175.9 μm in BRVO group, and from 223.0 ± 43.1 μm to 705.6 ± 244.6 μm in the CRVO group.

Conclusions: In RVO patients treated with ranibizumab the macular microcystic changes could be commonly detected after resolution of macular edema. The presence of these changes may be used as an early indicator for recurrence of ME and decrease of BCVA in the next weeks. In these patients the follow-up visit should be scheduled within 4-6 weeks.

Commercial Relationships: Matus Rehak, Allergan (R), Bayer (F), Bayer (R), Novartis (F), Novartis (R); Maria Tsui, None; Peter M. Wiedemann, Bayer (R), Novartis (F), Novartis (R).

Program Number: 3390 Poster Board Number: C0084
Presentation Time: 11:00 AM–12:45 PM
Optical Coherence Tomography Findings in Retinal Artery Occlusion
Richard M. Feist1,2, John O. Mason1,2, Martin L. Thomley1,2, Michael A. Albert1,2, Claudia M. Ayala1. 1Retina Consultants of Alabama, Birmingham, AL; 2Ophthalmology, UAB, Birmingham, AL.

Purpose: To characterize the acute, subacute, and chronic optical coherence tomography (OCT) findings of retinal arterial occlusion (RAO) to simplify the identification and staging of these cases.

Methods: Retrospective review of charts, and OCT images and measurements of patients diagnosed with retinal artery occlusion with comparison to uninvolved fellow eyes.

Results: Three distinct phases of OCT changes were seen. Patients in the acute phase with clinically evident inner retinal edema and opacification demonstrated a featureless opacity of the inner retina with loss of all layer detail and increased inner retinal thickness. This evolved into a subacute stage in which the featureless opacity gradually transformed into a speckled pattern of hyper-reflectance and a late chronic phase in which resolution of the opacity revealed loss of inner retinal volume and partial return of inner retinal organization. Of the first eleven eyes evaluated with central RAO, 5 presented with acute changes, 2 with subacute changes, and 4 with chronic changes.

Conclusions: OCT offers a non-invasive method of confirming the diagnosis and staging of retinal arterial occlusions.

Commercial Relationships: Richard M. Feist, None; John O. Mason, None; Martin L. Thomley, None; Michael A. Albert, None; Claudia M. Ayala, None.

Support: Research to Prevent Blindness Departmental Grant

Program Number: 3391 Poster Board Number: C0084
Presentation Time: 11:00 AM–12:45 PM
Distinctive Pattern Of Ganglion Cell Layer Loss In Early Ischemic Optic Neuropathy
Carlos E. Mendoza-Santiesteban1,2, Nimesh Patel1, Caitlin Monaco1, Thomas R. Hedges1. 1Ophthalmology - New England Eye Center, Tufts Medical Center. Tufts University, Boston, MA; 2Neurology - Dysautonomia Center, NYU Medical Center. New York University, New York, NY.

Purpose: To compare the ganglion cell layer (GCL) thickness measurements to retinal nerve fiber layer (RNFL) analysis in patients affected by ischemic optic neuropathy (ION) using high definition optical coherence tomography (HD-OCT).

Methods: Twenty-five subjects with the diagnosis of ischemic optic neuropathy were recruited during the period August-December 2013. A second group of thirty age-matched controls was also included.
Full neuro-ophthalmologic evaluation was carried-out including Cirrus HD-OCT to evaluate the GCL and RNFL thickness. Statistical analysis was done using Mann-Whitney U test to compare RNFL vs. GCL thicknesses between patients and controls.

**Results:** All patients with ION showed decreased GCL thickness when compared with the control group (P<0.001). RNFL was thinner in twenty-one patients (p<0.05). In four patients with acute ischemic optic neuropathy there was GCL loss despite an increase of the RNFL thickness compared to the control group. GCL analysis showed a better correlation with the visual field defects than RNFL.

**Conclusions:** GCL thickness analysis proved to be a sensitive biomarker to detect early damage of the retinal structure after an ION event. In acute cases GCL thickness is reduced earlier than RNFL, which usually showed increased thickness for several weeks after the acute event due to axonal swelling. In non-acute ION cases presenting with optic nerve pallor, GCL analysis showed an altitudinal pattern of ganglion cells loss. This HD-OCT observation can be useful in diagnosing remote ION in patients presenting with long-term visual loss, optic nerve pallor and atypical visual field defects.

**Commercial Relationships:** Carlos E. Mendoza-Santiesteban, None; Nimesh Patel, None; Caitlin Monaco, None; Thomas R. Hedges, None

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**Program Number:** 3392 **Poster Board Number:** C0085  
**Presentation Time:** 11:00 AM–12:45 PM

**Comparison of optic nerve parameters in children with high hyperopia and emmetropia measured with HRT II and OCT**

*Yaroslava Wener, Vanessa Brauer, Apostolos Lazaridis, Thomas Bertelmann, Walter Sekundo.* Ophthalmology, University Hospital Marburg, Marburg, Germany.

**Purpose:** To investigate with HRT II and OCT (Optovue-100) normal parameters of the optic nerve head in full term children with high hyperopia and compare them to children with low hyperopia and emmetropia.

**Methods:** Optic nerve was examined with HRT II and peripapillary nerve fiber layer with Optovue-100 in 5-15 year old full term children with normal visual acuity and high hyperopia (≥ +3.0 dpt) and low hyperopia and emmetropia (< +3.0 dpt to -1.0 dpt). Prior to study participation retinoscopy in cycloplegia was performed. One examination was performed on each eye. Optic nerve parameters of the both groups were compared with Wilcoxon-Mann-Whitney Test. Eye with higher amount of hyperopia was included in the study.

**Results:** 35 children were included in the study, 17 of them were highly hyperopic. Mean refraction of the hyperopic eyes was +5.5 dpt ± 1.5 dpt, of the emmetropic eyes +0.65 dpt ± 1.2 dpt, (mean age of subjects 10 ± 2.7 years). There was no significant difference in peripapillary nerve fiber layer thickness (OCT) between the two groups. There was a significant difference in disc area (1.33 ± 0.36 mm² vs. 1.79 ± 0.40 mm², p=0.008) and rim area (1.09 ± 0.30 mm² vs. 1.38 ± 0.34 mm², p=0.03) between the highly hyperopic and emmetropic group. No significant difference was found between the remaining HRT parameters including rim volume.

**Conclusions:** OCT in contrast to HRT II did not show any differences between children with high hyperopia and emmetropia. Optic discs in highly hyperopic eyes are more crowded as they are smaller in diameter but possess similar rim volume as emmetropic eyes.

**Commercial Relationships:** Yaroslava Wener, None; Vanessa Brauer, None; Apostolos Lazaridis, None; Thomas Bertelmann, None; Walter Sekundo, None

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**Program Number:** 3393 **Poster Board Number:** C0086  
**Presentation Time:** 11:00 AM–12:45 PM

**Ganglion Cell Layer Analysis in Patients with Optic Disc Hemorrhage**


**Purpose:** To explore the relationship between optic disc hemorrhage and retinal ganglion cell layer thickness in patients with primary open angle glaucoma.

**Methods:** A retrospective review of 50 patients with disc hemorrhages was conducted. Patients who were imaged with spectral domain optical coherence tomography with ganglion cell analysis were included in the study. Macular ganglion cell-inner plexiform layer measurements were obtained using Zeiss Cirrus HD-OCT software.

**Results:** Patients with optic disc hemorrhage suffered from ganglion cell layer thinning. Average macular ganglion cell-inner plexiform layer measurements were significantly (p<0.05) thinner in eyes which suffered a disc hemorrhage (66um) when compared to fellow eyes without a history of disc hemorrhage (75um). The average amount of time between disc hemorrhage discovery and latest ganglion cell layer analysis was 1,105 days.

**Conclusions:** Patients with optic disc hemorrhage exhibited macular ganglion-inner plexiform layer thinning measured by spectral domain OCT.

**Commercial Relationships:** George J. Parlitis, None; Esther Chung, None; Nathan M. Radcliffe, None
C. Oliver, None; Naresh Mandava, None; Hugo Quiroz-Mercado, None

Program Number: 3395 Poster Board Number: C0088
Presentation Time: 11:00 AM–12:45 PM
Evaluation of Optical Coherence Tomography in Patients with Vigabatrin Toxicity Identified by ERG

Ananthavalli Kumarappah,1 Carol A. Westall,2 Arun Reginald,2 Ray Buncic,3 1Institute of Medical Sciences, University of Toronto, Toronto, ON, Canada; 2Ophthalmology and Vision Sciences, The Hospital for Sick Children, Toronto, ON, Canada.

Purpose: Vigabatrin, an antiepileptic drug, is associated with visual field reductions in 30-50% of adults (vigabatrin attributed field loss, VAFL). The 30-Hz flicker electroretinogram (ERG) is recommended for screening young children taking the drug. Vigabatrin ERG reduction (VAER) is reported if there has been significant reduction in age-corrected 30-Hz flicker amplitude from the baseline measurement on two consecutive visits. VAFL has also been associated with peripapillary retinal nerve fibre layer (RNFL) thickness attenuation. The purpose of this study is to evaluate the relationship between VAER in a pediatric population and peripapillary RNFL parameters by optical coherence tomography (OCT). This study also aims to understand changes in the combined ganglion cell layer (GCL) and inner plexiform layer (IPL) in patients with VAER. To date, no other study has reported on GCL/IPL thickness at the macula in vigabatrin patients.

Methods: This cross-sectional study includes individuals who were previously on VGB and monitored for toxicity using ERG. Thirteen of 22 individuals were able to undergo OCT testing and four of the 13 individuals developed VAER during treatment. The 13 participants underwent the optic disc (200x200) and macular cube (512x128) scans were performed at the fovea in a subset. OCT was performed (RTVue-100; Optovue Inc) in normal controls. OCT cross-sections and quantitative measurements in normal subjects were present our current interpretation of outer retinal layers obtained with OCT. This study also aims to understand changes in the combined ganglion cell layer (GCL) and inner plexiform layer (IPL) in patients with VAER.

Results: Individuals with VAER exhibited attenuated global RNFL at the optic disc compared to individuals without vigabatrin toxicity (p<0.0001). Three of four individuals with VAER manifested thinning of the nasal, superior and inferior quadrants in the presence of a normal temporal nerve fiber layer. Spatial mapping by clock hour segments shows that all superior segments are significantly attenuated and that the temporal segments are the least attenuated. GCA did not reveal any differences in the thickness of the GCL/IPL between participants with and without VAER. However, upon spatial analysis, we note a slight reduction in the thickness of the inferior segment of the GCL/IPL.

Conclusions: Visual field testing is difficult in this population due to developmental and cognitive delays. RNFL attenuation correlates strongly with VAER suggesting that OCT imaging may be a potential alternative to ERG testing for monitoring vigabatrin toxicity.

Commercial Relationships: Ananthavalli Kumarappah, None; Carol A. Westall, Lundbeck Pharmaceuticals (F); Arun Reginald, None; Ray Buncic, None

Program Number: 3396 Poster Board Number: C0089
Presentation Time: 11:00 AM–12:45 PM
Functional and structural outcomes in the Posner-Schlossman syndrome

Sonja Valsero Franco, Sergio Pinar, Joseba Artaraz, Beatriz Jiménez Gómez, Maria Elena Gonzalez-Montpetit, Ana Orive, Alex Fonollosa. Oftalmologia, Hospital universitario de cruces, Bilbao, Spain.

Purpose: Posner-Schlossman syndrome has been classically considered a benign uveitic condition. However, some recent papers and our own clinical experience have shown that glaucoma may be a relatively frequent complication in these patients. The aim of our study was to describe the clinical characteristics and the functional and OCT-related structural outcomes in patients with Posner-Schlossman syndrome.

Methods: Cross sectional study of patients with Posner-Schlossman syndrome diagnosed at Cruces University Hospital. Variables recorded: age, gender, follow-up, number of previous attacks, mean intraocular pressure during attacks, CMV infection, damage in retinal nerve fibers layer and ganglion cells layer assessed by OCT and visual field abnormalities assessed by Humphrey visual field perimeter (24-2). Statistics: Mann Whitney U test. The level of statistical significance was set at p<0.05.

Results: 22 eyes of 21 patients (15 men, 6 women) were included. Mean age: 37.4±9.3. Follow-up: 60 months [5-360], number of previous attacks: 4 [1-20], mean intraocular pressure during attacks: 39±7 mm Hg. 17% needed surgery to control intraocular pressure. Five out of 13 patients in which an aqueous humour tap was performed were positive for CMV (PCR). Frequency of glaucomatous defects in affected eyes was 62% versus 35% in non affected. Regarding OCT results, we did not find statistical significant differences between affected and non affected eyes: Retinal Nerve Fiber Layer Thickness (83,25 versus 88,21 micron, p=0,33) and average Ganglion Cell Layer thickness (75,6 versus 81,05 micron p=0,32). CMV positive affected eyes presented worse structural outcomes regarding Retinal Nerve Fiber Layer Thickness (67 versus 89,62 microns p=0,016) and Ganglion Cell Layer thickness (56,80 versus 81,5 microns p=0,019) than CMV negative eyes.

Conclusions: Patients with Posner-Schlossman syndrome presented visual field abnormalities in affected eyes frequently. We have not observed significant differences in OCT parameters when comparing affected and non affected eyes. CMV positive eyes may present worse structural outcomes than CMV negative eyes.

Commercial Relationships: Sonia Valsero Franco, None; Sergio Pinar, None; Joseba Artaraz, None; Beatriz Jiménez Gómez, None; Maria Elena Gonzalez-Montpetit, None; Ana Orive, None; Alex Fonollosa, None

Program Number: 3397 Poster Board Number: C0090
Presentation Time: 11:00 AM–12:45 PM
Hypotheses about the Identity of Outer Retinal Microstructure in OCT Cross-sections and Quantitative Measurements in Normal Subjects


Purpose: Cross-sectional imaging of the human retina by OCT produces layers of differing backscatter intensity. Correspondence between these OCT layers and histologically definable structures have been evolving over the last two decades as the axial, lateral and temporal resolution of the OCT systems improve, and with increasing observations in molecularly-clarified retinal pathology. Here we present our current interpretation of outer retinal layers obtained with a commercial OCT instrument.

Methods: OCT was performed (RTVue-100; Optovue Inc) in normal subjects (n=22; ages 8-62) with un-averaged line scans. Dense raster scans were performed at the fovea in a subset.

Results: There were at least four hyperscattering bands distal (choroidal) to the hyposcattering band commonly agreed to correspond to the outer nuclear layer. In proximal to distal order, Band 1 is thought to be at the outer limiting membrane (OLM) and Band 2 at or near the ellipsoid region of inner segments (ISe). The distance between Bands 1 and 2 would be expected to be...
proportional to the photoreceptor inner segment length and it varied from 33.5±2.19 um (mean±sd) at the foveola to 24.0±1.94 and 22.2±2.22 um at 4 mm superior and inferior retina, respectively. Band 3 is thought to be near the interface between cone outer segment tips and the RPE contact cylinder, and the distance between Bands 2 and 3 would be expected to be proportional to the cone photoreceptor outer segment length, which varied from 38.1±2.77 um at the foveola to 14.8±3.32 and 10.2±3.27 um at 4 mm superior and inferior retina, respectively. Band 4 had two distinct sub-peaks across the retina except for the foveola. The proximal subpeak Band 4a is hypothesized to correspond to the interdigitation of rod outer segment tips with RPE apical processes, and the distal subpeak Band 4b is hypothesized to correspond to the interface near basal RPE and Bruch’s membrane. The missing Band 4a at the foveola would correspond to the rod-free zone. The thickness between Band 2 and Band 4a would be proportional to rod outer segment length and it ranged from 47.7±2.85 um outside the foveola to 33.1±2.21 um and 31.4±2.23 um at 4 mm superior and inferior retina, respectively.

Conclusions: Hypotheses about outer retinal structural identities need to be tested in concert with results in molecularly-clarified diseases primarily affecting rods or cones.

Commercial Relationships: Artur V. Cideciyan, None; Alexander Sumaroka, None; Samuel G. Jacobson, None

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