

**Retinal Oxymetry using Oxymap T1 at
ARVO 2016**

Sunday

Wide-field, high-resolution retinal oximetry

Sun, May 01
8:30am - 10:15am
Exhibit/Poster Hall

Posterboard #: A0318

Abstract Number: 123 - A0318

Author Block: *David Bragason¹, Sveinn H. Hardarson¹, Einar Stefansson¹*

¹ Ophthalmology, Landspítali University Hospital, Reykjavik, Iceland

Disclosure Block: David Bragason, None; Sveinn H. Hardarson, Oxymap (Code I (Personal Financial Interest)), Oxymap (Code P (Patent)); Einar Stefansson, Oxymap (Code I (Personal Financial Interest)), Oxymap (Code P (Patent))

Purpose: To construct wide-field and high-resolution oxygen saturation maps of the eye fundus using a retinal oximeter and custom software to improve our understanding of oxygen metabolism of the retina in health and disease.

Methods: We use the commercial dual-wavelength, spectrophotometric retinal oximeter Oxymap T1 (Oxymap, Iceland) to image the eye fundus of healthy volunteers and patients with eye diseases. Several images are obtained from each eye at different resolutions and fundus locations. Our custom software, based on the image processing programs ImageJ (NIH, USA) and i2kRetina (DualAlign, LLC), automatically constructs a seamless mosaic of the images complete with a color-coded map of oxygen saturation values for every point on the retinal vessel tree.

Results: Our detailed oxygen saturation maps combine a wider effective field of view, obtained by automatic mosaicing of several images, and higher spatial resolution than has been published before to our knowledge. The resulting images allow a more accurate assessment of topographical variability in oxygen metabolism and intravascular gradients resulting from laminar oxygen transport. Improved spatial definition allows measurements of smaller vessels than was previously possible with the oximeter used.

Conclusions:

Our novel wide-field, high-resolution oxygen saturation maps yield a more complete picture of patterns of variability in retinal vessel oxygen saturation than has been previously possible. We expect they will be a valuable tool in further studies on the role of oxygen metabolism in the retina.

Monday

Correlation of parameters of laser speckle flowgraphy and retinal oximeter in healthy subjects

Mon, May 02

8:30am - 10:15am
Exhibit/Poster Hall

Posterboard #: C0115

Abstract Number: 1659 - C0115

Author Block: *Atsushi Hayashi¹, Shinya Abe¹, Mari Miyakoshi¹, Takuya Nakagawa¹*

¹ University of Toyama, Toyama, Toyama, Japan

Disclosure Block: Atsushi Hayashi, None; Shinya Abe, None; Mari Miyakoshi, None; Takuya Nakagawa, None

Purpose: To examine correlations between parameters of laser speckle flowgraphy (LSFG) and parameters of retinal oximeter in the eyes of healthy subjects.

Methods: Thirty one eyes of 31 healthy volunteer people (18 male and 13 female, range 19 to 75 years old) were included in this study. They underwent ophthalmoscopy examinations and LSFG (Nidek, Aichi, Japan) and retinal oximetry using Oxymap T1 (Oxymap ehf, Reykjavik, Iceland). Mean blur rate (MBR), blowout time (BOT), and blowout score (BOS) of the optic disc and retinal blood flow (RFV), BOT, and BOS of retinal vessels were obtained with LSFG in each eye. Oxygen saturations and diameters of retinal vessels of the same portions as measured by LSFG were obtained with Oxymap T1 in each eye. The parameters were statistically analyzed by Spearman's rank-order correlation test.

Results: The BOT of the optic disc measured by LSFG was weakly correlated with the oxygen saturations of retinal arterioles in healthy subjects (Spearman correlation=-0.46, p=0.008). The RFV of retinal venules was weakly correlated with the oxygen saturations of retinal venules in healthy subjects (Spearman correlation=-0.41, p=0.0001). The RFV of retinal arterioles and venules were significantly correlated with the vessel diameters of retinal arterioles (Spearman correlation=-0.60, p=0.0001) and venules (Spearman correlation=-0.70, p=0.0001), respectively.

Conclusions: Blood flow parameters of BOT and RFV measured by LSFG were correlated with oxygen saturations and vessel diameters of retinal vessels measured by Oxymap T1 in healthy subjects.

Retinal Oximetry in a Healthy Japanese Population

Mon, May 02
8:30am - 10:15am
Exhibit/Poster Hall

Posterboard #: C0120

Abstract Number: 1664 - C0120

Author Block: *Yuki Nakano¹, Takeru Shimazaki¹, Nobuko Kobayashi¹, Yukiko Miyoshi¹, Aoi Ono¹, Mamoru Kobayashi¹, Chieko Shiragami¹, Kazuyuki Hirooka¹, Akitaka Tsujikawa¹*

¹ Department of Ophthalmology, Kagawa University Faculty of Medicine, Kida-gun, Kagawa, Japan

Disclosure Block: Yuki Nakano, None; Takeru Shimazaki, None; Nobuko Kobayashi, None; Yukiko Miyoshi, None; Aoi Ono, None; Mamoru Kobayashi, None; Chieko Shiragami, None; Kazuyuki Hirooka, None; Akitaka Tsujikawa, None

Purpose: To establish the normative database of retinal oximetry using Oxymap T1 in a healthy Japanese population, and study the reproducibility and validity of the measurements in Japanese.

Methods: We measured oxygen saturation in the major retinal vessels with Oxymap T1 in 252 eyes of 252 healthy Japanese subjects. Reproducibility of retinal oximetry was investigated using 20 eyes of 20 healthy subjects. To investigate the validity of the measurements, retinal oximetry was performed before and after breathing through a paper bag in 12 eyes of 12 healthy subjects.

Results: The mean retinal oxygen saturation of 4 quadrants in healthy Japanese was $97.0 \pm 6.9\%$ in arteries and $52.8 \pm 8.3\%$ in veins. The mean arteriovenous difference in oxygen saturation was $44.2 \pm 9.2\%$. Interphotograph, intervisit, and interevaluator intraclass correlation coefficients were 0.936–0.979, 0.809–0.837, and 0.732–0.947, respectively. In the major retinal arteries, oxygen saturation increased with age ($r=0.18$, $p<0.01$), at a rate of 0.67% per 10 years. However, venous oxygen saturation showed no correlation with age. In parallel with systemic oxygen saturation, arterial oxygen saturation decreased from $97.2 \pm 5.4\%$ to $90.2 \pm 6.7\%$ after paper-bag breathing ($p<0.01$), and returned to the baseline level ($97.0 \pm 5.9\%$) after room-air breathing. However, venous oxygen saturation showed no significant change with paper-bag breathing.

Conclusions: Mean retinal oximetry in 4 quadrants with Oxymap T1 has high reproducibility and validity.

Normative Values of Retinal Oxygen Saturation in Rhesus Monkeys: The Beijing Intracranial and Intraocular Pressure (iCOP) Study

Mon, May 02
11:00am - 12:45pm
Exhibit/Poster Hall

Posterboard #: D0101

Abstract Number: 2205 - D0101

Author Block: *Jing Li¹, Diya Yang¹, Yiquan Yang¹, Ningli Wang¹*

¹ Ophthalmology, Beijing Tongren Hospital, Beijing, China

Disclosure Block: Jing Li, None; Diya Yang, None; Yiquan Yang, None; Ningli Wang, None

Purpose: To study the normal values of the retinal oxygen saturation in Rhesus Monkeys and to evaluate repeatability and reproducibility of retinal oxygen saturation measurements.

Methods: Eighteen adult Rhesus macaque monkeys were included in this experimental study. An Oxymap T1 retinal oximeter (Oxymap, Reykjavik, Iceland) was used to perform oximetry on all subjects. Global arterial (SaO₂) and venous oxygen saturation (SvO₂), arteriovenous difference in SO₂ were measured. In the first examination, each eye was imaged three times. At the following two examinations, each eye was imaged once. Intraclass correlation coefficient (ICC) was determined.

Results: Average SaO₂ and SvO₂ were $89.48 \pm 2.64\%$ and $54.85 \pm 2.18\%$, respectively. The global A-V difference was $34.63 \pm 1.91\%$. The highest A-V difference in SO₂ and lowest saturations were found in the inferotemporal quadrant. Intra-session and inter-visit repeatability were both high. For all oxygen saturation parameters, the ICC values of the intra-session repeatability ranged between 0.92 and 0.96. The lowest values were in the infero-temporal quadrant. As found previously, a relatively high ICC value for inter-visit repeatability also was found for all oxygen saturation measurements, ranging between 0.86 and 0.94, with the lowest values in the infero-nasal quadrant.

Conclusions: Our study is the first to describe retinal SO₂ in healthy Rhesus monkeys. In normal monkey eyes, the reproducibility and repeatability of retinal oximetry oxygen saturation measurements were high in the retinal arterioles and venules. In conclusion, our results support retinal oximetry as suitable for assessing changes in follow-up examinations for ocular diseases in experimental monkey studies.

Tuesday

Relationship between oxygen saturation of the retinal vessels and visual field defect in glaucoma patients: comparison with each hemifield

Tue, May 03
8:30am - 10:15am
Exhibit/Poster Hall

Posterboard #: A0337

Abstract Number: 2988 - A0337

Author Block: Kazuyuki Hirooka¹, Takeru Shimazaki¹, Yuuki Nakano¹, Eri Nitta¹, Kaori Ukegawa¹, Shino Sato¹, Akitaka Tsujikawa¹

¹ Ophthalmology, Kagawa Univ Faculty of Medicine, Kita-gun, Kagawa, Japan

Disclosure Block: Kazuyuki Hirooka, None; Takeru Shimazaki, None; Yuuki Nakano, None; Eri Nitta, None; Kaori Ukegawa, None; Shino Sato, None; Akitaka Tsujikawa, None

Purpose: To investigate the relationship between visual field defects in the upper and lower hemifields and the corresponding oxygen saturation of the retinal vessels in patients with glaucoma.

Methods: This study enrolled 44 glaucoma patients who had more than a 10 dB difference between the upper and lower total deviation (TD). Retinal vessel oxygen saturation was measured with a non-invasive spectrophotometric retinal oximeter. The hemifields in one eye of each patient were divided into worse (worse TD) and better (better TD) hemifield areas. We also examined an additional 40 glaucoma patients who had less than a 5 dB difference between upper and lower TD. Statistical analysis was performed using a Student's t-test.

Results: Mean venous saturation of oxygen (SaO₂) was higher in the worse (59.0 ± 8.0%) versus the better (55.4 ± 7.2%) hemifield (P < 0.01). The mean arteriovenous difference in the SaO₂ was lower in the worse (44.4 ± 9.0%) versus the better (48.6 ± 11.4%) hemifield (P = 0.02). However, no statistical difference was found for the retinal SaO₂ in the venous vessels or for the arteriovenous difference between the worse and better hemifield in patients with less than a 5 dB difference in the upper and lower hemifield TD.

Conclusions: Advanced glaucomatous visual field defects are associated with increased SaO₂ in the venous vessels and a decreased arteriovenous difference in the SaO₂. Data suggest that there is a reduced retinal oxygen consumption in eyes with glaucomatous damage due to retinal ganglion cell loss.

Abnormal retinal venous oxygen saturation in retinal vascular disease

Tue, May 03
11:00am - 12:45pm
Exhibit/Poster Hall

Posterboard #: D0237

Abstract Number: 3745 - D0237

Author Block: Sveinn H. Hardarson^{1,2}, Toke Bek³, Thorunn S. Eliasdottir^{1,2}, Einar Stefansson^{1,2}

¹ University of Iceland, Reykjavik, Iceland; ² Ophthalmology, Landspítali, Reykjavik, Iceland; ³ Department of Ophthalmology, Aarhus University Hospital, Aarhus, Denmark

Disclosure Block: Sveinn H. Hardarson, Oxymap ehf. (Code C (Consultant)), Oxymap ehf. (Code I (Personal Financial Interest)), Oxymap ehf. (Code P (Patent)); Toke Bek, None; Thorunn S. Eliasdottir, None; Einar Stefansson, Oxymap ehf. (Code I (Personal Financial Interest)), Oxymap ehf. (Code P (Patent)), Oxymap ehf. (Code S (Non-remunerative))

Purpose: Mean retinal venous oxygen saturation has been found to be different from normal in diabetic retinopathy and central retinal vein occlusion. Many diabetic retinopathy patients appear to have only mild changes that are likely to be within the normal range. The purpose of the study was to characterize normal range of retinal venous oxygen saturation and further examine patients that fall outside normal range.

Methods: Retinal oximetry was performed with the Oxymap T1 retinal oximeter. The oximeter acquires images at 570nm and 600nm. Software automatically estimates light absorbance of blood vessels and calculates their oxygen saturation.

Retinal oximetry was performed in 54 patients with diabetic retinopathy, 54 age- and gender matched healthy individuals and 14 patients with central retinal vein occlusion. Oxygen saturation was measured in the widest superotemporal venule in one eye of each subject.

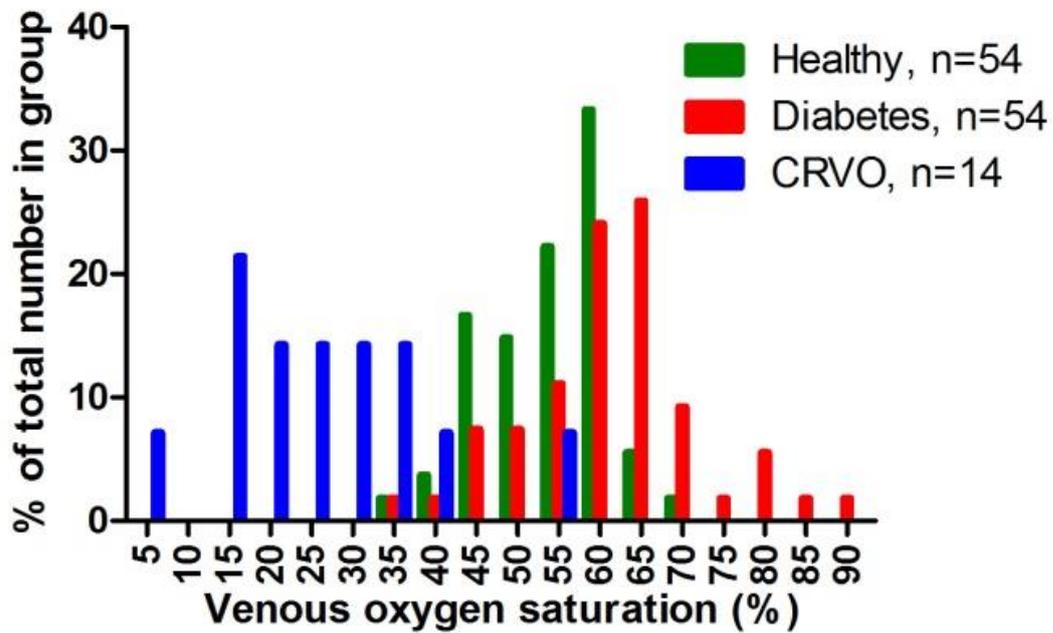
Results: In the healthy group, 5% of venous saturation values were below 38%, while 5% of venous values were above 63%. Eleven CRVO patients (79%) had lower than 38% venous saturation. Twenty-five diabetic patients (46%) had venous values above 63%. The percentage of diabetic patients with values above 95% of healthy was highest for the subgroup with proliferative diabetic retinopathy (71%) while the corresponding percentage was 46% for non-proliferative DR and 25% for patients with diabetes and no retinopathy. The figure shows the distribution of venous values for the main subject groups.

Mean venous saturation was significantly lower than normal in the CRVO patients and significantly higher than normal in the diabetic group ($p < 0.0001$ for both comparisons). Venous saturation was significantly greater ($p < 0.05$) in patients with proliferative DR or non-proliferative DR, compared to either healthy or diabetic patients with no retinopathy. The table shows mean values for all groups.

Conclusions: Most CRVO patients have venous saturation below the normal limit. Although there is overlap in venous saturation between patients with diabetes and normal, a considerable proportion of diabetic patients falls outside the normal range and this is particularly true for patients with the most advanced retinopathy.

Layman Abstract (optional): Provide a 50-200 word description of your work that non-scientists can understand. Describe the big picture and the implications of your findings, not the study itself and the associated details.: We use retinal oximetry to measure oxygen saturation in blood vessels of the retina. The study characterizes the normal range for oximetry values and shows that a large part of patients with

either central retinal vein occlusion or diabetic retinopathy falls outside the normal range. This may be a step towards clinical use of retinal oximetry.



Distribution of retinal venous oxygen saturation in healthy individuals and in patients with either diabetes or CRVO.,

	Venous saturation (% , mean±SD)	N
Healthy	54±7	54
CRVO	27±12	14
All diabetic patients	61±10	54
Proliferative diabetic retinopathy	67±9	14
Non-proliferative diabetic retinopathy	63±9	24
No diabetic retinopathy	54±10	16

The table shows mean venous saturation for the studied groups.

Normal limits of retinal oximetry and retinal venous oxygen saturation in atrophic diseases

Tue, May 03
11:00am - 12:45pm
Exhibit/Poster Hall

Posterboard #: D0238

Abstract Number: 3746 - D0238

Author Block: *Olof B. Olafsdottir*^{1,3}, *Sveinn H. Hardarson*^{1,3}, *Evelien Vandewalle*², *Thor Eysteinnsson*^{1,3}, *Maria S. Gottfredsdottir*³, *Karel Van Keer*², *Luis Abegao Pinto*⁴, *Ingeborg Stalmans*², *Einar Stefansson*^{3,1}
¹ University of Iceland, Reykjavik, Iceland; ² University Hospitals Leuven, Leuven, Belgium; ³ Landspítali University Hospital, Reykjavik, Iceland; ⁴ Centro Hospitalar de Lisboa Central, Lisbon, Portugal

Disclosure Block: Olof B. Olafsdottir, None; Sveinn H. Hardarson, Oxymap ehf. (Code I (Personal Financial Interest)), Oxymap ehf. (Code E (Employment)), Oxymap ehf. (Code P (Patent)); Evelien Vandewalle, None; Thor Eysteinnsson, Oxymap ehf. (Code I (Personal Financial Interest)), Oxymap ehf. (Code P (Patent)); Maria S. Gottfredsdottir, None; Karel Van Keer, None; Luis Abegao Pinto, None; Ingeborg Stalmans, None; Einar Stefansson, Oxymap ehf. (Code I (Personal Financial Interest)), Oxymap ehf. (Code P (Patent)), Oxymap ehf. (Code S (Non-remunerative))

Purpose: Disturbances in retinal metabolism have been detected in atrophic diseases such as glaucoma and retinitis pigmentosa (RP). There have been speculations that metabolic imaging of the retina could be helpful in monitoring these diseases and perhaps help with diagnosis. The aim of the project was to establish normal limits for retinal oximetry and test whether results from patients with glaucoma and RP fit within these limits.

Methods: Retinal vessel oxygen saturation was measured in 89 healthy individuals, 78 patients with primary open angle glaucoma and normal tension glaucoma and 10 patients with RP. Measurements were performed with a spectrophotometric retinal oximeter, Oxymap T1. The oximeter simultaneously acquires two images of the same area of the fundus at two different wavelengths of light, 600nm and 570nm. A specialized software automatically measures light absorbance of retinal vessels and calculates oxygen saturation.

Results: In the healthy group, 5% of the venous saturation values were above 64%. Six glaucoma patients (8%) and two RP patients (20%) had venous saturation higher than 64%. Mean venular oxygen saturation was higher in advanced glaucoma (MD \geq 10dB) compared with healthy individuals (57.9% \pm 5.5% vs. 53.8% \pm 6.4%, p=0.007, mean \pm SD). Venous saturation in RP was also higher than in healthy individuals (58.0% \pm 6.2% vs. 53.8% \pm 6.4%, p=0.05). The visual field mean defect in the six glaucoma patients outside the 95% limit for healthy individuals ranged from -1dB (good visual field) to 26.7dB (advanced visual field).

Conclusions: Most of the patients in both groups (glaucoma and RP) were within normal limits for venular oxygen saturation, even though glaucoma patients with advanced visual field damage and RP patients have increased venular oxygen saturation compared with healthy individuals.

	Healthy (n=89)	Glaucoma			RP*
		All (n=78)	Mild (n=36) MD=5dB	Advanced (n=22) MD=10dB	
Arterioles	93.3±4.1	94.1±3.2	93.9±3.3	94.6±2.4	91.7±3.7
Venules	53.8±6.4	55.3±7.0	53.7±7.3	57.9±5.5	58.0±6.2

*n=7 for arterioles, n=10 for venules

Table. Mean retinal vessel oxygen saturation in healthy individuals, glaucoma and RP patients.,

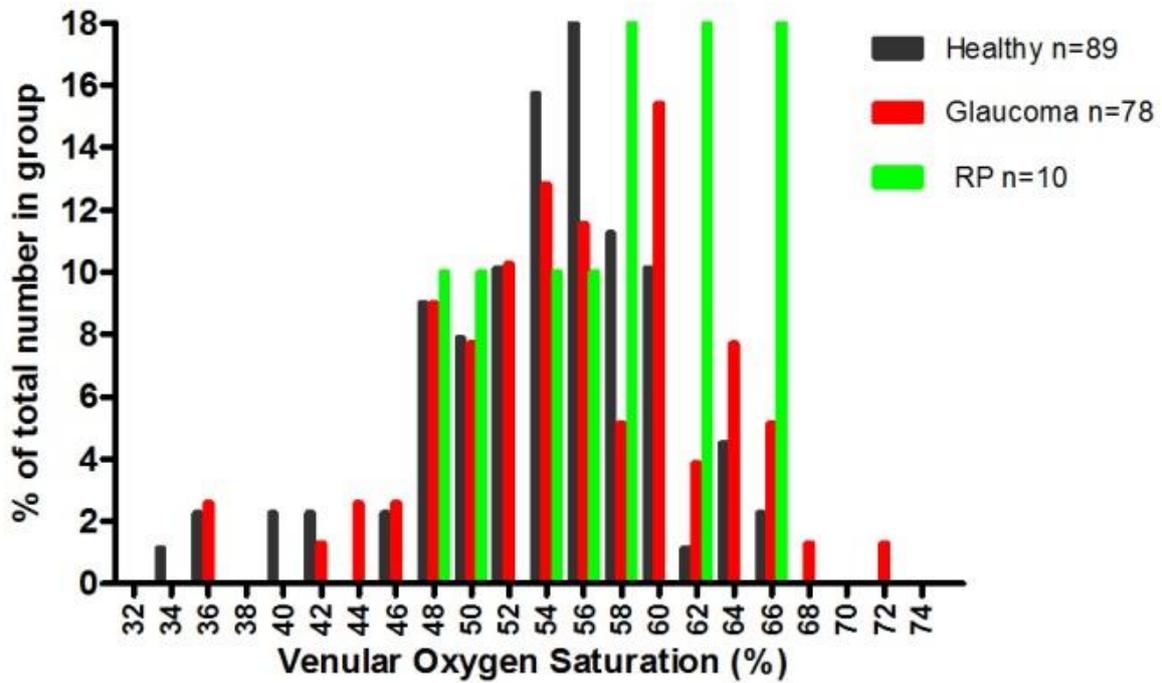


Figure. The relative frequency of venous oxygen saturation levels in healthy individuals, glaucoma patients and RP patients.

Automatic quantitative oximetry analysis in smaller retinal microvessels acquired by the retinal function imager, RFI, non-invasively

Tue, May 03
11:00am - 12:45pm
Exhibit/Poster Hall

Posterboard #: D0240

Abstract Number: 3748 - D0240

Author Block: Sagi -. Reuven^{1,2}, Rona Wilf⁴, Frederick -. Rotbart¹, Jianhua Wang⁵, Delia DeBuc⁵, Ashwin Mohan⁶, Amiram Grinvald³

¹ Optical Imaging Ltd, Rehovot, Israel; ² IDC Hertzelia, Herzelia, Israel; ³ Neurobiology, Weizmann Institute of Science, Rehovot, Israel; ⁴ Optical Imaging, Rehovot, Israel; ⁵ Bascom Palmer Eye Institute, Miami, Florida, United States; ⁶ Narayana Nethralaya, Bangalore, India

Disclosure Block: Sagi -. Reuven, Optical Imaging Ltd (Code I (Personal Financial Interest)), Optical Imaging Ltd (Code E (Employment)), Optical Imaging Ltd (Code F (Financial Support)); Rona Wilf, Optical Imaging Ltd (Code C (Consultant)); Frederick -. Rotbart, Optical Imaging Ltd (Code E (Employment)), Optical Imaging Ltd (Code I (Personal Financial Interest)); Jianhua Wang, Optical Imaging Ltd (Code F (Financial Support)), Optical Imaging Ltd (Code C (Consultant)); Delia DeBuc, Optical Imaging Ltd (Code F (Financial Support)), Optical Imaging Ltd (Code C (Consultant)); Ashwin Mohan, None; Amiram Grinvald, Optical Imaging Ltd (Code I (Personal Financial Interest)), Optical Imaging Ltd (Code C (Consultant)), Weizmann Institute of Science (Code P (Patent))

Purpose: To increase the spatial resolution of oximetric measurement in small retinal microvessel vessels from about 75 μ m, down to ~30 μ m, and to carry out automatic quantitative analysis of the data acquired by the (RFI).

Methods: Data analysis by the new software was carried out on eyes of 16 healthy and 21 diseased subjects. It was acquired with the RFI according to standard Helsinki approved protocol. Retinal images were acquired with a FOV of 20° field (4.3x4.3 mm²) or 35° (7.4x7.4mm²). The RFI includes a fast stroboscopic flash system to acquire short movies and a fast filter wheel to change the color of each flash. The quality of quantitative oximetric analysis is notoriously difficult particularly from small vessels because of signal to noise ratio limitations. To reduce the noise we collected multiple series of 8 flashes and in each series we collected 8 images at 4 different wavelength of 555, 569, 577 and 586nm, using the rapid filter wheel. This facilitated having three sets for ODR calculations rather than one customarily done by OxyMap. We averaged their independent results. To further reduce the noise novel algorithms were developed.

Results: We completed the algorithms and the program for the fully automatic quantitative analysis thus replacing the previous RFI's semi-automatic but only qualitative analysis. The new software generates a topological map of the vessels and micro vessels; (ii) Measures the diameter at every position along each vessel in the images (iii) Measures the net vessel absorption. We validated the present results by comparing them to oximetry maps publications. We found that most published data included oxygen saturation values only down to vessels diameter of ~75 μ m. Even in larger vessels oxygen saturation values appeared noisy. We determined oxygen saturation values down to 30 \pm 7 μ m using a FOV of 20°. Average diameter was 46.5 μ m. Range 12-180 μ m. The relative STD of oxygen saturation values for the three ODR pairs (555,569; 569,577; 577,586), for all the pixels along the vessels was 15.3%.

Conclusions: Mapping oximetry at high spatial resolution should prove useful for early diagnosis, preventive treatment and its monitoring. The RFI system and its new fully automatic analysis software now provide multi qualitative and quantitative measurements of functional and structural parameters.



Thursday

Optic disc centered imaging versus quadrant imaging in retinal oximetry

Thu, May 05
8:00am - 9:45am
Exhibit/Poster Hall

Posterboard #: D0015

Abstract Number: 5924 - D0015

Author Block: Ashwin Mohan^{1,2}, Tos TJM Berendschot², Caroll Webers², Chaitra Jayadev^{1,2}, Padmamalini Mahendradas¹, Naresh Kumar Yadav¹

¹ Vitreo-retina, Narayana Nethralaya, Bangalore, India; ² Maastricht University, Maastricht, Netherlands

Disclosure Block: Ashwin Mohan, None; Tos TJM Berendschot, None; Caroll Webers, None; Chaitra Jayadev, None; Padmamalini Mahendradas, None; Naresh Kumar Yadav, None

Purpose: To compare intra eye variation in retinal vessel oxygen saturation in optic disc centered versus quadrant imaging

Methods: Forty two consecutive healthy subjects were included in the study. Patients with corrected distance vision acuity less than 20/30, cataract or other significant media opacities, history of ocular or systemic disease or history of smoking that can confound measurements were excluded. After dilatation with 1% tropicamide and 10% phenylephrine all patients had 50 degree optic disc centered images and images of 4 quadrants (superotemporal - ST, superonasal - SN, inferonasal - IN and inferotemporal - IT) taken on the Oxymap T1 retinal oximeter (Oxymap hf. Reykjavik, Iceland). The thickest arteriole and venule (>100µm) were chosen in each quadrant in the optic disc centered images. For quadrant images averaged values of 3 segments of thickest arterioles and venules (>100µm) were chosen in each quadrant. The intra-eye variation between arteriolar and venous saturation (%) was compared between optic disc centered and quadrant images. As a secondary objective we also chose smaller vessels (70 – 100 µm) in the quadrant images to map the oximetry changes through the retinal circulation.

Results: Optic disc centered images gave average arteriolar saturation (%) of 89, 94, 94 and 88 and venous saturation of 58, 61, 60 and 52 in the ST, SN, IN and IT respectively. For quadrant images the average arteriolar saturation was 94, 94, 94 and 91 and the venous saturation was 62, 60, 61 and 59 in the ST, SN, IN and IT respectively. The average intra eye variation was 11.8 ± 5.7 for arterioles; 11.7 ± 4.5 for venules in optic disc centered images and 7.1 ± 3.6 for arterioles; 7.5 ± 3.2 for venules for quadrant images. The intra eye variation was significantly less ($p < 0.001$ for arterioles and venules) for quadrant images when compared to optic disc centered images. In the quadrant images, the average saturation in the large arterioles was 93, small arterioles 91, small venules 68 and large venules was 61.

Conclusions: Quadrant imaging had significantly reduced intra eye variation in comparison to optic disc centered images. This larger variation observed in optic disc centered images could be artifactual. We also see a physiologically reducing saturation - large arterioles > small arterioles > small venules > large venules.

Layman Abstract (optional): Provide a 50-200 word description of your work that non-scientists can understand. Describe the big picture and the implications of your findings, not the study itself and the

associated details.: Normative retinal oximetry measurements in optic disc centered images have shown large intra eye variations. On studying the oxy haemoglobin dissociation curve we find that these observations indicate larger intra eye variations in tissue oxygen which cannot be explained physiologically. This is hence likely to be artifactual. Can quadrant images help to reduce this measured variation?

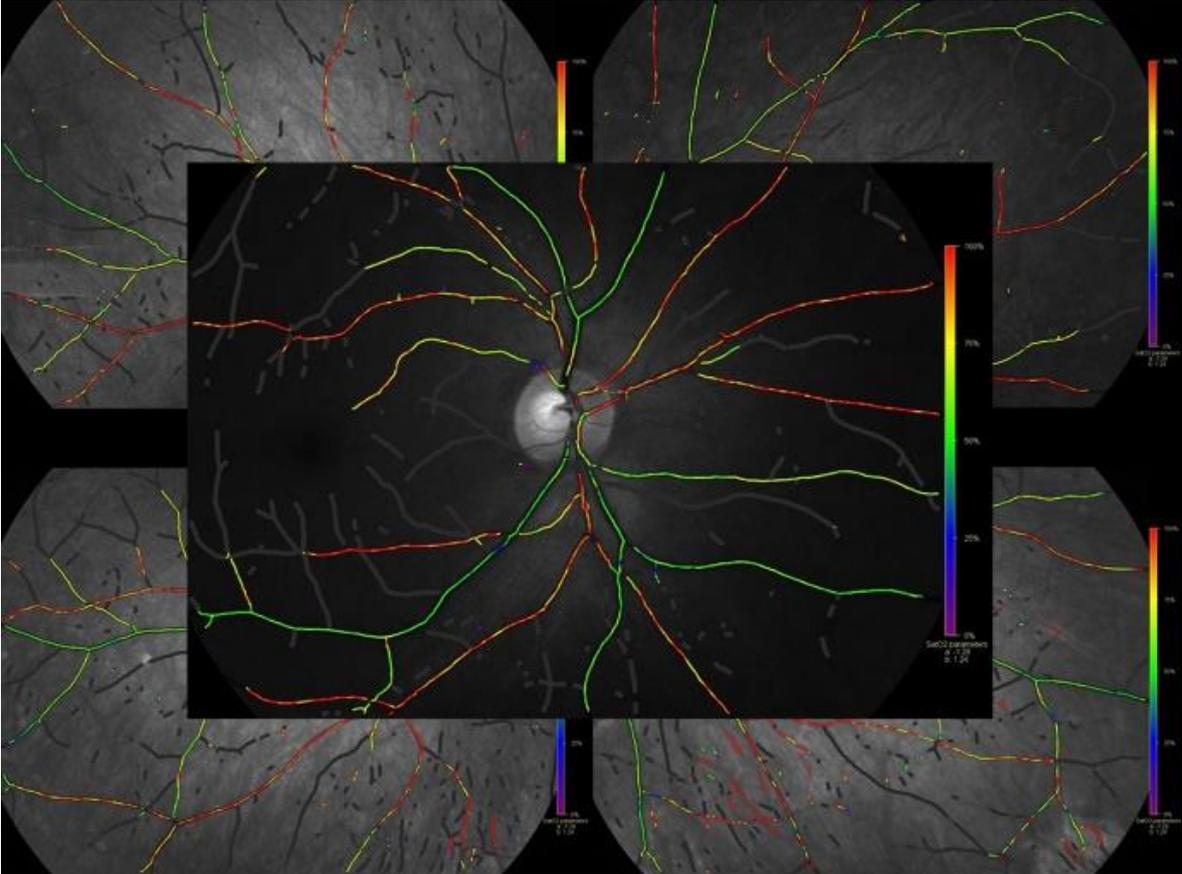


Figure showing optic disc centered versus quadrant images

Improvement in retinal venous oxygen saturation after panretinal photocoagulation is predictive of progression of proliferative diabetic retinopathy

Thu, May 05
11:00am - 12:45pm
Exhibit/Poster Hall

Posterboard #: C0143

Abstract Number: 6356 - C0143

Author Block: *Thomas L. Torp*^{1,4}, *Ryo Kawasaki*², *Tien Y. Wong*³, *Tunde Peto*^{5,4}, *Jakob Grauslund*^{1,4}
¹ Ophthalmology, Odense University Hospital, Odense, Fyn, Denmark; ² The Department of Public Health, Yamagata University Faculty of Medicine, Yamagata, Japan; ³ General Cataract and Comprehensive Ophthalmology, Singapore National Eye Center, Singapore, Singapore; ⁴ The Clinical Research Institute, University of Southern Denmark, Odense, Fyn, Denmark; ⁵ The NIHR Biomedical Research Centre, Moorfields Eye Hospital NHS Foundation Trust and UCL Institute of Ophthalmology, London, United Kingdom

Disclosure Block: Thomas L. Torp, None; Ryo Kawasaki, None; Tien Y. Wong, None; Tunde Peto, OPTOS (Code F (Financial Support)); Jakob Grauslund, None

Purpose: We performed a prospective, interventional clinical study on patients with proliferative diabetic retinopathy (PDR) in order to investigate changes in retinal oximetry before and three months after panretinal photocoagulation (PRP) and to correlate this to PDR-activity.

Methods: Thirty-nine eyes from 34 patients with diagnosed PDR were included. We performed wide-field fluorescein angiography (WFA) (Optomap; Optos PLC., Dunfermline, Scotland, UK) and retinal oximetry (Oxymap model T1; Oxymap, software version 2.4.2, Reykjavik, Iceland) at baseline and three months after PRP by a navigated laser (NAVILAS[®]; OD-OS GmbH, Berlin, Germany). At follow-up, WFA was used to evaluate PDR activity and patients were categorized into two groups: progression (Group 1, n=10) or stability/regression of PDR (Group 2, n=29). Retinal oximetry measurements were performed on optic disc centered images using the in-built software that automatically marked the vessels; one larger arteriole and venule in each quadrant were identified for measurements, pre-specified protocol.

Results: At baseline, mean age and duration of diabetes were 54.8± years and 21.7± years, respectively, and 72% were male. HbA1c was 67±mmol/mol, and the mean blood pressure was 152/84mmHg. Retinal arterial and venous saturation was 96.7% and 67.4%, respectively.

Patients in Group 1 and 2 did not differ in baseline retinal arterial and venous oxygen saturation, number of laser spots delivered, total laser energy delivered, or change in retinal arterial oxygen saturation after PRP (-1.2% vs. -0.4%, p=0.92).

In contrast, as compared to baseline, the improvement in retinal vein oxygen saturation was significantly different between the groups (+2.7% for Group 1 vs. -3.5% for Group 2, p=0.02).

In a multivariable logistic regression analysis, adjusted for the mentioned variables, the change in retinal vein oxygen saturation between baseline and follow-up independently predicted PDR-progression (OR 1.31 per 1% increment in retinal venous oxygen saturation between baseline and follow-up, 95% CI 1.03-1.61, p=0.03).

Conclusions: Lack of reduction in retinal venous oxygen saturation after PRP was independently associated with PDR-activity. This might reflect absence in reduction in vascular endothelial growth factor (VEGF) and could be a potential non-invasive marker of disease activity.