

# MAESTRO CLINICAL COMPENDIUM

Summary of peer-reviewed clinical research



## PREFACE

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Topcon Healthcare's Maestro is a user-friendly optical coherence tomography (OCT) and fundus camera combination device. With a single click, Maestro's robotic technology automatically performs alignment, focus, and multimodal capture of high-resolution OCT images and a true-color retinal image. This clinical compendium provides an overview of peer-reviewed publications for the Maestro, highlighting its advancements in efficiency and diagnostic power in clinical practice.

### **NOTE:**

**Not all products and services are available in all markets.**

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Hsiao YS, Hou H, El-Nimri NW, Hood D, Tsamis E, Ko TH, Durbin M. Invest. Ophthalmol. Vis. Sci. 2024;65(7):4844.

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Sci Rep. 2023 Sep 23;13(1):15876.

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Paul JP, McGuinness MB, Ashby BD, Tan J, Barber NM, Weisinger HS, Martin KR, van Wijngaarden P, Larsen PD. J Glaucoma. 2023 Nov 28. doi: 10.1097/IJG.0000000000002339. Epub ahead of print.

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### 17 **Evaluation of macular thickness and volume tested by optical coherence tomography as biomarkers for Alzheimer's disease in a memory clinic**

Sánchez D, Castilla-Martí M, Marquié M, Valero S, Moreno-Grau S, Rodríguez-Gómez O, Piferrer A, Martínez G, Martínez J, Rojas I, Hernández I, Abdelnour C, Rosende-Roca M, Vargas L, Mauleón A, Gil S, Alegret M, Ortega G, Espinosa A, Pérez-Cordón A, Sanabria Á, Roberto N, Ciudín A, Simó R, Hernández C, Tàrraga L, Boada M, Ruiz A Sci Rep. 2020 Jan 31;10(1):1580. doi: 10.1038/s41598-020-58399-4.

## 18 VITREORETINAL DISORDERS

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Hou H, Durbin MK, El-Nimri NW, Fischer JL, Sadda SR\* Front Med. 2023 Dec 18; 10:1281751. doi: 10.3389/fmed.2023.1281751.

**20 Retinal microvascular signs in COVID-19**

Sim R, Cheung G, Ting D, Wong E, Wong TY, Yeo I, Wong CW

Br J Ophthalmol. 2022 Sep;106(9):1308-1312. doi: 10.1136/bjophthalmol-2020-318236.

**20 The Outcome of Manual Small Incision Cataract Surgery and Anterior Vitrectomy for Persistent Fetal Vasculature in an 18-Year-Old Woman: A One-Year Follow-Up**

Egbu E. Cureus. 2020 Sep 23;12(9):e10605. doi: 10.7759/cureus.10605

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**22 Evaluation of the Inclusion Of Spectral Domain Optical Coherence Tomography in a Telemedicine Diabetic Retinopathy Screening Program: A Real Clinical Practice**

Arruabarrena C, Rodríguez-Miguel A, Allendes G, Vera C, Son B, Teus M ARetina. 2023 Aug 1;43(8):1308-1316. doi: 10.1097/IAE.0000000000003832.

**23 Alabama Screening and Intervention for Glaucoma and Eye Health through Telemedicine (AL-SIGHT): Baseline Results**

Owsley C, Swain TA, McGwin G Jr, Nghiem VTH, Register S, Asif IM, Fazio M, Antwi-Adjei EK, Girkin CA, Rhodes LA Am J Ophthalmol. 2024 Jan;257:66-75. doi: 10.1016/j.ajo.2023.09.001. Epub 2023 Sep 7.

**24 Eye stroke protocol in the emergency department**

Bénard-Séguin É, Nahab F, Pendley AM, Rodriguez Duran M, Torres Soto M, Keadey M, Wright DW, Newman NJ, Biousse V. J Stroke Cerebrovasc Dis. 2024 Jul 28;33(9):107895. doi: 10.1016/j.jstrokecerebrovasdis.2024.107895. Epub ahead of print.

**25 Evaluating the impact of optical coherence tomography in diabetic retinopathy screening for an Aboriginal population**

O'Halloran RA, Turner AW

Clin Exp Ophthalmol. 2018 Mar;46(2):116-121. doi: 10.1111/ceo.13018.

**25 Automated Identification of Referable Retinal Pathology in Teleophthalmology Setting**

Gao Q, Amason J, Cousins S, Pajic M, Hadziahmetovic M

Transl Vis Sci Technol. 2021 May 3;10(6):30. doi: 10.1167/tvst.10.6.30.

**25 Use of Teleophthalmology for Evaluation of Ophthalmic Emergencies by Ophthalmology Residents in the Emergency Department**

Shah YS, Flitsos MJ, Alaqeel A, Boland MV, Zafar S, Srikumaran D, Woreta FA

Telemed J E Health. 2022 Jun;28(6):858-864. doi: 10.1089/tmj.2021.0334.

**25 Emergency Department Non-Mydriatic Fundus Photography Expediates Care For Patients Referred For “Papilledema”**

Lin MY, Ray H, Pendley A, Okrent Smolar AL, Duran M, Torres Soto M, Berman G, Bruce B, Wright D, Newman NJ, Biousse V. Invest. Ophthalmol. Vis. Sci. 2024;65(7):77.

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Haas Am, Ahmed D, Stattin M, Graf A, Krepler K, Ansari-Shahrezaei S. Acta Ophthalmol. 2021 Mar;99(2):E260-E266. Doi: 10.1111/Aos.14572. Epub 2020 Aug 24.

**28 Robotic Spectral-domain versus Swept-source OCT in the association between OCT-Angiography metrics and glaucoma severity**

Fazio MA, Clark ME, Girkin CA. Invest. Ophthalmol. Vis. Sci. 2024;65(7):1212.

**29 Microaneurysms Detection by Two Optical Coherence Tomography Angiography Devices**

Alibhai AY, Steffens T, Hou H, Durbin M, Waheed NK. Invest. Ophthalmol. Vis. Sci. 2024;65(7):5529.

# MAESTRO REFERENCE DATABASE & ASSOCIATED STUDIES

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# The development of a reference database with the Topcon 3D OCT-1 Maestro

**AUTHORS:** Chaglasian M, Fingeret M, Davey PG, Huang WC, Leung D, Ng E, Reisman CA\*

**PUBLICATION:** Clin Ophthalmol. 2018 May 7;12:849-857. doi: 10.2147/OPHTH.S155229.

\*MC, MF, and PGD received financial support from Topcon Medical Systems. WCH, DL, and CAR are employees of Topcon Medical Systems. EN is a consultant of Topcon for this work.

## STUDY PURPOSE

To report the range of thickness values for the new Topcon Maestro 3D OCT device with 2 scan size settings: the 12x9 mm wide field and 6x6 mm scans

## OVERVIEW



### STUDY DESIGN

Prospective, multicenter cohort study



### STUDY DEVICE

Topcon 3D OCT-1 Maestro



### # OF EYES/PATIENTS

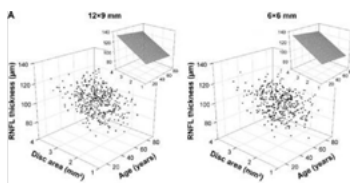
399 healthy eyes of 399 subjects



### OUTCOME MEASURES

Average and 1st, 5th, 95th, and 99th percentile ranges for OCT parameters: Early Treatment Diabetic Retinopathy Study macula full retinal thickness (FRT), ganglion cell + inner plexiform layer thickness (GCL + IPL), ganglion cell complex (GCC) thickness, circumpapillary retinal nerve fiber layer (cpRNFL) thickness

## RESULTS



**FIGURE 1.** The relationships of cpRNFL thickness with age and disc area displayed in the 3D scatter plots. Adapted from Clin Ophthalmol. 2018 May 7;12:849-857. doi: 10.2147/OPHTH.S155229.

- The mean age was  $46.3 \pm 16.3$  years (ranged 18–88 years) and 57% of the subjects were female
- Eighteen percent of the subjects were Hispanic or Latino. Fifty-nine percent of the subjects were Caucasians, followed by Black/African American (20%), Asian (13%), Native American/Pacific Islander (2%), and American Indian/Alaskan Native (1%)
- The mean foveal FRT was  $237.079 \pm 20.899 \mu\text{m}$  for the 12x9 mm scan and  $234.000 \pm 20.657 \mu\text{m}$  for the 6x6 mm scan; FRT reduced with age in the outer ETDRS quadrants
- The mean GCL + IPL thickness was  $71.363 \pm 5.924 \mu\text{m}$  for the 12x9 mm scan and  $71.726 \pm 5.880 \mu\text{m}$  for the 6x6 mm scan; a reduction in GCL + IPL thickness was seen with age
- The mean GCC thickness was  $105.949 \pm 8.533 \mu\text{m}$  for the 12x9 mm scan and  $106.698 \pm 9.094 \mu\text{m}$  for the 6x6 mm scan; overall, GCC thickness decreased with age
- The mean cpRNFL thickness was  $104.720 \pm 11.829 \mu\text{m}$  for the 12x9 mm scan and  $104.036 \pm 11.341 \mu\text{m}$  for the 6x6 mm scan; age had little or no effect, whereas disc area showed large degree of influence on the cpRNFL thickness (Figure 1)

## CONCLUSIONS

Across all parameters, the measurements obtained by the 12x9 wide, the 6x6 macula, and 6x6 disc scan modes on the Topcon 3D OCT-1 Maestro were generally similar and their trends were consistent with those in the literature. The reference limits at the 1st, 5th, 95th, and 99th percentile points establish thresholds to provide for the quantitative comparison of the RNFL, optic nerve head, and the macula in the human retina to a database of known healthy eyes.



# Optic disc morphometry using spectral domain optical coherence tomography in a Nigerian population

**AUTHORS:** Awe OO, Onakpoya OH, Adeoye AO.

**PUBLICATION:** Eur J Ophthalmol. 2021 Apr 16:11206721211008781. doi: 10.1177/11206721211008781.  
Epub ahead of print.

## STUDY PURPOSE

To assess morphological optic disc dimensions using spectral-domain optical coherence tomography (OCT) in a Nigerian population

## OVERVIEW



### STUDY DESIGN

Retrospective



### STUDY DEVICE

Topcon 3D OCT-1  
Maestro



### # OF EYES/PATIENTS

147 eyes of 88 subjects



### OUTCOME MEASURES

Disc area (DA), vertical disc diameter (VDD), and horizontal disc diameter (HDD)

## RESULTS

- The mean age of the study subjects was  $52.6 \pm 20.9$  years with a range of 8-90 years; male to female ratio was 1:1.3
- The mean DA, VDD, and HDD were  $2.54 \pm 0.48$  mm<sup>2</sup>,  $1926.5 \pm 189.6$  μm and  $1673.9 \pm 173.9$  μm, respectively
- Males had significantly larger DA than females ( $2.56 \pm 0.53$  mm<sup>2</sup> vs  $2.51 \pm 0.44$  mm<sup>2</sup>,  $p = 0.043$ )
- The mean DA and VDD of eyes of subjects aged 21-40 years were significantly higher compared to subjects aged 60 years and older ( $p = 0.008$  and  $0.001$ , respectively)

## CONCLUSIONS

The mean optic disc area and diameters are larger than those reported in similar studies involving blacks and other races. The mean disc area was found to be larger in subjects aged 21-40 years in comparison to subjects aged 60 and older.

# Comparison of the Thickness of the Fiber Layer of the Retinal Nerves in Spectral Domain Optical Coherence Tomography in Normal Eyes Older Than 40 Years

**AUTHORS:** Gündogan M, Kiliç S.

**PUBLICATION:** Klin Monbl Augenheilkd. 2021 Sep 15. English. doi: 10.1055/a-1554-5663. Epub ahead of print.

## STUDY PURPOSE

To compare measurements of the thickness of the retinal nerve fibre layer (RNFL) and assess the agreement between three different devices for spectral domain optical coherence tomography

## OVERVIEW



### STUDY DESIGN

Prospective, cross-sectional



### STUDY DEVICE(S)

- Topcon Maestro
- Canon HS100
- NIDEK RS-3000



### # OF EYES/PATIENTS

46 eyes of 23 subjects



### OUTCOME MEASURES

Average RNFL thickness, four quadrants (superior, inferior, nasal, and temporal) of RNFL thickness

## RESULTS

- The average RNFL thickness measured by the three OCT devices was correlated ( $p < 0.001$ ), but differed significantly between the three devices
- Topcon Maestro showed the highest average RNFL thickness value; the mean average RNFL thickness was  $98.5 \pm 6.6 \mu\text{m}$  as measured by Canon HS100,  $108.5 \pm 8.8 \mu\text{m}$  as measured by Topcon Maestro, and  $104.9 \pm 9.0 \mu\text{m}$  as measured by NIDEK RS-3000
- Bland-Altman plots revealed considerable agreement among the three devices, except for the inferior quadrants between Topcon Maestro and NIDEK RS-3000 measurements

## CONCLUSIONS

Although the peripapillary RNFL thickness measurements taken with Topcon Maestro, Canon HS100, and NIDEK RS-3000 were in good agreement, they were not interchangeable in clinical practice, as the values differed significantly.

# Optical Coherence Tomography Retinal Nerve Fibre Layer and Ganglion Cell Complex Measurements in Normal Southern Nigerian Eyes

**AUTHORS:** Obasuyi OC, Osuji UE, Ifijen CO, Imafidon MA, Ovienria WA, Eguaojie IE, Eigbedion TE, Alikah AA.

**PUBLICATION:** Cureus. 2022 Dec 29;14(12):e33101. doi: 10.7759/cureus.33101

## STUDY PURPOSE

To provide the measurements of RNFL, GCL, and GCL+IPL in normal eyes of southern Nigerian patients and specifically to evaluate the relationship of these measurements to gender, age, intra-eye variability, and the Topcon SD-OCT normative database

## OVERVIEW



### STUDY DESIGN

Cross-sectional retrospective



### STUDY DEVICE

Topcon 3D OCT-1 Maestro



### # OF EYES/PATIENTS

304 eyes of 152 patients



### OUTCOME MEASURES

Retinal nerve fiber layer (RNFL), ganglion cell layer (GCL), and ganglion cell layer + inner plexiform layer (GCL + IPL)

## RESULTS

- The male-to-female ratio was 1:1, and ages ranged between 18 and 71 for both genders
- The average RNFL values were  $111.49 \pm 10.44$  for the right eye (RE) and  $111.96 \pm 9.66$  for the left eye (LE)
- For the GCL, average values were  $66.23 \pm 4.4$  (RE) and  $66.34 \pm 4.19$  (LE). GCL+IPL values were  $104.02 \pm 6.71$  (RE) and  $103.89 \pm 6.66$  (LE)
- There was no difference between genders ( $X^2 = 56.467$ ;  $df = 46$ ;  $p = 0.160$ ), and RNFL, GCL, and GCL+IPL values showed a significant reduction as the age of the respondents increased
- There was a significant difference between RNFL, GCL, and GCL+IPL values and the Topcon reference database,  $p < 0.001$

## CONCLUSIONS

Significant differences exist between the Southern Nigerian eyes' RNFL, GCL, and GCL+ IPL values and the Topcon 3D OCT-1 Maestro reference database, which should be considered while diagnosing and managing glaucoma with the OCT.

## CONGRESS PRESENTATIONS AND POSTERS

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### **Anatomical features can affect the thickness of optical coherence tomography (OCT) measures used for clinical decisions and clinical trial endpoints**

La Bruna S, Tsamis E, Durbin M, Lee C, Hsiao YS, Ganihanova A, De Moraes G, Hood DC. Invest. Ophthalmol. Vis. Sci. 2024;65(7):2539.

### **Comparison of Optic Disc Size between two Spectral Domain Imaging Devices**

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### **Automated Grading of OCT Reports for Usability in a Reference Database**

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# GLAUCOMA

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# Agreement and Precision of Wide and Cube Scan Measurements between Swept-source and Spectral-domain OCT in Normal and Glaucoma Eyes

**AUTHORS:** Hou H, El-Nimri NW, Durbin MK, Arias JD, Moghimi S, Weinreb RN\*

**PUBLICATION:** Sci Rep. 2023 Sep 23;13(1):15876.

\*HH, NE-N, MD, JA are Topcon employees. RNW is a consultant for Topcon.

## STUDY PURPOSE

To evaluate agreement of Wide scan measurements from swept-source optical coherence tomography (SS-OCT) Triton and spectral-domain OCT (SD-OCT) Maestro in normal/glaucoma eyes, and to assess the precision of measurements from Wide and Cube scans of both devices

## OVERVIEW



### STUDY DESIGN

Prospective



### STUDY DEVICE(S)

- 3D OCT-1 Maestro
- DRI OCT Triton



### # OF EYES/PATIENTS

25 normal eyes &  
25 glaucoma eyes



### OUTCOME MEASURES

Circumpapillary retinal nerve fiber layer (cpRNFL), macular ganglion cell layer + inner plexiform layer (GCL + IPL/abbreviated to GCL+), and ganglion cell complex (abbreviated to GCL++)

## RESULTS

- GCL++ thickness measurements from both the wide scan and the macular cube scan on the Maestro showed CV within 1% for repeatability and reproducibility for both normal and glaucoma groups, with the exception of CV% of reproducibility for the Superior Nasal region in the Glaucoma group, which was 1.1%
- GCL+ thickness measurements from both the wide scan and the macular cube scan on the Maestro showed CV within 1.1% for repeatability and reproducibility for the normal group RNFL thickness measurements from both the wide scan and the optic disc cube scan on the Maestro showed CV within 3.2% for repeatability and reproducibility for the normal group
- RNFL thickness measurements from both the wide scan and the optic disc cube scan on the Maestro showed CV within 3.2% for repeatability and reproducibility for the normal group
- Wide scan measurements from both devices have shown excellent agreement with each other (intercepts did not significantly differ from 0 and the slopes did not differ significantly from 1)
- The differences between Triton and Maestro (mean difference of all measurements  $<3 \mu\text{m}$ ) were less than the axial resolution in tissue (Triton axial resolution  $8 \mu\text{m}$ , Maestro axial resolution  $6 \mu\text{m}$ ), and smaller than the corresponding reproducibility limits

## CONCLUSIONS

- Wide scan measurements from both devices have shown excellent agreement with each other in both normal and glaucoma eyes.
- Precision of cpRNFL, macular GCL+, and macular GCL++ thickness measurements from the Wide and the Macular/Optic Disc Cube scans were high and similar for both devices in normal and glaucoma eyes.
- Measurement differences between Triton and Maestro are assumed to not be of clinical significance (mean difference below resolution in tissue).
- Wide scans, including the ONH and the macula, may provide benefits for glaucoma diagnosis and management as they demonstrate interchangeable measurement and high precision.

# Increased Glaucoma Case-finding Through Routine Optical Coherence Tomography in Optometry Practice

**AUTHORS:** Paul JP, McGuinness MB, Ashby BD, Tan J, Barber NM, Weisinger HS, Martin KR, van Wijngaarden P, Larsen PD

**PUBLICATION:** Glaucoma. 2023 Nov 28. doi: 10.1097/IJG.0000000000002339. Epub ahead of print.

## STUDY PURPOSE

To assess whether the routine use of optical coherence tomography (OCT) by optometrists for detection of glaucomatous changes in the optic nerve and retina increased glaucoma referrals to ophthalmologists

## OVERVIEW



### STUDY DESIGN

Retrospective



### STUDY DEVICE(S)

- Maestro 3D OCT-1
- CenterVue DRS fundus camera



### # OF EYES/PATIENTS

Electronic medical records of 994,461 patients from 195 optometry practices in Australia were included for analysis; 175 practices performed OCT routinely on all patients and 20 practices were without OCT



### OUTCOME MEASURES

Primary: referral to an ophthalmologist for glaucoma assessment.  
Secondary: rate of false positive referrals

## RESULTS

- A total of 10,475 (1.1%) were referred to an ophthalmologist for first assessment or review of previously suspected glaucoma
- Practices employing routine OCT were more likely to refer patients for glaucoma assessment (n=9719/900651, 1.1%) than were practices without OCT devices (n=756/93810, 0.8%)
- Patients of all ages were more likely to be referred from practices with OCTs, and magnitude of relative difference on log scale decreased with age (joint interaction  $p < 0.001$ )
- Referred patients younger than 40 years old from OCT practices were much more likely to have IOP within the normal range ( $\leq 21$  mmHg) (66%) compared to younger referred patients from non-OCT practices (47%)
- Ophthalmologist feedback was received for 318 of the referred patients in the primary analysis, among which 129 (41%) were diagnosed with glaucoma, 121 (38%) were deemed glaucoma suspects, and no sign of glaucoma was detected in 68 (21%)
- The proportion of patients with no glaucoma did not differ by practice OCT status, IOP range, or gender

## CONCLUSIONS

- Australian optometric practices that employed OCT technology exhibited a 34% higher odds of referring patients for ophthalmologists' evaluation of glaucoma compared to practices without OCT devices, which suggests the routine inclusion of OCT imaging increases the detection of glaucoma by optometrists.
- Adoption of OCT as a routine clinical tool in optometry may reduce the burden of undiagnosed glaucoma and lead to improved visual outcomes.
- Further research is needed to ascertain the false positive detection rate.

# NEURODEGENERATIVE DISORDERS

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## PEER-REVIEWED PUBLICATIONS

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### **Usefulness of peripapillary nerve fiber layer thickness assessed by optical coherence tomography as a biomarker for Alzheimer's disease**

Sánchez D, Castilla-Martí M, Rodríguez-Gómez O, Valero S, Piferrer A, Martínez G, Martínez J, Serra J, Moreno-Grau S, Hernández-Olasagarre B, De Rojas I, Hernández I, Abdelnour C, Rosende-Roca M, Vargas L, Mauleón A, Santos-Santos MA, Alegret M, Ortega G, Espinosa A, Pérez-Cordón A, Sanabria Á, Ciudin A, Simó R, Hernández C, Villoslada P, Ruiz A, Tàrraga L, Boada M  
Sci Rep. 2018 Nov 5;8(1):16345. doi: 10.1038/s41598-018-34577-3. Erratum in: Sci Rep. 2019 Nov 8;9(1):16713.

### **Evaluation of macular thickness and volume tested by optical coherence tomography as biomarkers for Alzheimer's disease in a memory clinic**

Sánchez D, Castilla-Martí M, Marquié M, Valero S, Moreno-Grau S, Rodríguez-Gómez O, Piferrer A, Martínez G, Martínez J, Rojas I, Hernández I, Abdelnour C, Rosende-Roca M, Vargas L, Mauleón A, Gil S, Alegret M, Ortega G, Espinosa A, Pérez-Cordón A, Sanabria Á, Roberto N, Ciudin A, Simó R, Hernández C, Tàrraga L, Boada M, Ruiz A  
Sci Rep. 2020 Jan 31;10(1):1580. doi: 10.1038/s41598-020-58399-4.

# VITREORETINAL DISORDERS

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# Agreement, repeatability, and reproducibility of quantitative retinal layer assessment using swept-source and spectral-domain optical coherence tomography in eyes with retinal diseases

**AUTHORS:** Hou H, Durbin MK, El-Nimri NW, Fischer JL, Sadda SR\*

**PUBLICATION:** Front Med. 2023 Dec 18; 10:1281751. doi: 10.3389/fmed.2023.1281751.

\*HH, MD and NE-N are employed by Topcon Healthcare. SS received research support from Topcon.

## STUDY PURPOSE

To evaluate the agreement and precision of retinal thickness measurements obtained using swept-source optical coherence tomography (SS-OCT) and spectral-domain OCT (SD-OCT) in healthy eyes and eyes with retinopathy

## OVERVIEW



### STUDY DESIGN

Prospective



### STUDY DEVICE

- 3D OCT-1 Maestro
- DRI OCT Triton



### # OF EYES/PATIENTS

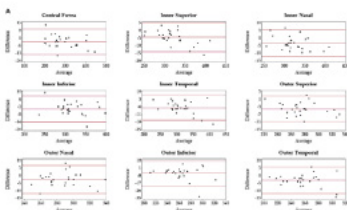
25 normal eyes and 26 eyes with retinal disease, including age-related macular degeneration, macular hole, and diabetic retinopathy



### OUTCOME MEASURES

Thickness of the full retina, ganglion cell layer (GCL) + inner plexiform layer (IPL) (GCIPL/abbreviated to GCL+), and ganglion cell complex (GCC/abbreviated to GCL++)

## RESULTS



**FIGURE 1.** Bland-Altman plots show all the average full retinal thickness measurement differences between Maestro and Triton macular cube scans are less than 6  $\mu\text{m}$  in eyes with retinal disease.

- Overall, measurement differences between Triton and Maestro were  $<6 \mu\text{m}$ ; mean differences of full retina, GCL++, and GCL+ thickness were  $\leq 5.5 \mu\text{m}$ , 1.3  $\mu\text{m}$ , and 2.8  $\mu\text{m}$ , respectively and not statistically significant across the parameters (Figure 1)
- Maestro and Triton showed excellent agreement with one another; most of the 95% confidence intervals (CI) for intercept contained 0 and CI for slope contained 1
- Full retinal thickness measurements from the Maestro wide and macular cube scans showed a maximum coefficient of variance (CV) of 1.8% for repeatability and reproducibility in normal and retina groups
- GCL+ thickness measurements from both the wide scan and the macular cube scan on the Maestro showed CV within 1.1% for repeatability and reproducibility for the normal group and showed CV range of 0.7% to 3.5% for the retina group
- In the normal group, all the repeatability and reproducibility CVs of Maestro were within 1% for GCL++
- In the retina group, the maximum repeatability and reproducibility CVs were 3.0% and 3.0% for the wide scan, and 1.8% and 2.1% for the macular cube scan on the Maestro for GCL++

## CONCLUSIONS

- The repeatability and reproducibility estimates indicate high precision in both normal and retina groups for full retinal thickness, GCL+, and GCL++ measurements using the Maestro SD-OCT and Triton SS-OCT.
- As expected and consistent with other studies, the repeatability and reproducibility in eyes with retinal disease were worse compared with healthy eyes.
- This study demonstrated excellent agreement of retinal thickness measurements between the Maestro SD-OCT and Triton SS-OCT.

## PEER-REVIEWED PUBLICATIONS

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### **Retinal microvascular signs in COVID-19**

Sim R, Cheung G, Ting D, Wong E, Wong TY, Yeo I, Wong CW

Br J Ophthalmol. 2022 Sep;106(9):1308-1312. doi: 10.1136/bjophthalmol-2020-318236.

## CASE STUDY

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### **The Outcome of Manual Small Incision Cataract Surgery and Anterior Vitrectomy for Persistent Fetal Vasculature in an 18-Year-Old Woman: A One-Year Follow-Up**

Egbu E. Cureus. 2020 Sep 23;12(9):e10605. doi: 10.7759/cureus.10605.

# TELEMEDICINE AND REMOTE CONSULTATION

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# Evaluation of the Inclusion Of Spectral Domain Optical Coherence Tomography in a Telemedicine Diabetic Retinopathy Screening Program: A Real Clinical Practice

**AUTHORS:** Arruabarrena C, Rodríguez-Miguel A, Allendes G, Vera C, Son B, Teus MA

**PUBLICATION:** Retina. 2023 Aug 1;43(8):1308-1316. doi: 10.1097/IAE.0000000000003832.

## STUDY PURPOSE

To evaluate whether combining spectral domain optical coherence tomography (SD-OCT) with monoscopic fundus photography using a nonmydriatic camera (MFP-NMC) improves the accuracy of diabetic macular edema (DME) referrals in a teleophthalmology diabetic retinopathy screening program

## OVERVIEW



### STUDY DESIGN

Cross-sectional study



### STUDY DEVICE(S)

Topcon 3D OCT-1 Maestro: 3-field MFP-NMC centered on macula, disc, and superior-temporal, and a 6x6 macula raster OCT scan



### # OF EYES/PATIENTS

3,819 eyes of 1,925 patients with diabetes (Type I or II)



### OUTCOME MEASURES

Prevalence of DME using different diagnostic criteria defined for MFP-NMC and SD-OCT, diagnostic accuracy of DME when SD-OCT was added to a retinography-based teleophthalmology DR screening program

## RESULTS

- The prevalence of DME in MFP-NMC was found to be 1.52%, 1.83%, and 1.22% according to English National Screening Program (ENSP), Scotland National Screening Program (SNSP), and central hard exudates criteria, respectively
- Using SD-OCT, the prevalence of DME was 1.75% for center involved diabetic macular edema, 8.77% had a macular volume of  $>8 \text{ mm}^3$ , 8.45% showed foveal or parafoveal thickening, and 1.54% had foveal or parafoveal thickening with anatomical signs of DME
- Sensitivity barely reached 50% in MFP-NMC and less for the quantitative criteria of spectral domain optical coherence tomography
- When macular thickening and anatomical signs of DME were considered for the OCT criterion, sensitivity increased to 88.3% with a 99.8% specificity, and the false DMEs and non-gradable images were reduced

## CONCLUSIONS

- Incorporation of SD-OCT into MFP-NMC using an all-in-one device within a well-established diabetic screening program improved the diagnostic accuracy of DME.
- Macular thickening and anatomical signs showed the highest suitability for screening, with a sensitivity of 88.3% and a specificity of 99.8%. Notably, MFP-NMC alone missed half of the true DMEs that lacked indirect signs.

# Alabama Screening and Intervention for Glaucoma and Eye Health through Telemedicine (AL-SIGHT): Baseline Results

**AUTHORS:** Owsley C, Swain TA, McGwin G Jr, Nghiem VTH, Register S, Asif IM, Fazio M, Antwi-Adjei EK, Girkin CA, Rhodes LA

**PUBLICATION:** Am J Ophthalmol. 2024 Jan;257:66-75. doi: 10.1016/j.ajo.2023.09.001. Epub 2023 Sep 7.

## STUDY PURPOSE

To describe baseline results of the Alabama Screening and Intervention for Glaucoma and Eye Health through Telemedicine (AL-SIGHT) for patients at federally qualified health centers (FQHCs). Candidates were persons at risk for glaucoma-associated diseases (GAD) based on age, race/ethnicity, current diagnosis of GAD, family history, and diabetes

## OVERVIEW



### STUDY DESIGN

Baseline screening visit followed by remote diagnosis and referral for follow-up examinations at 3 FQHCs



### STUDY DEVICE(S)

Maestro2 SD-OCT, QuickSee or Retinomax autorefractor, iCare portable rebound tonometer, Humphrey Field Analyzer 3 or Melbourne Rapid Fields



### # OF EYES/PATIENTS

First 500 participants enrolled in the AL-SIGHT program between November 2020 and June 2022; mean age was 58 years; 45.6% were African American and 51.6% White



### OUTCOME MEASURES

Detection rates of eye disease, rate of referral by the ophthalmologist for follow-up eye care, rate of patients adhering to attending follow-up care, and patient satisfaction

## RESULTS

- Remote diagnostic evaluation of ocular screening by an ophthalmologist revealed 29.7% GAD, 6.8% diabetic retinopathy, 37.6% cataract, 67.3% refractive error, 9.2% other eye conditions
- Fundus photographs were unreadable for 32 right eyes and 28 left eyes; OCT images were unreadable for 52 right eyes and 61 left eyes. Visual field data were unreliable in the HFA for 168 right eyes and 176 left eyes, and in the Melbourne Rapid Field test for 234 right eyes and 210 left eyes
- In all, 47.2% of the participants were referred for follow-up examination and for acuity 20/40 or worse or IOP  $\geq$ 23 mm Hg in one or both eyes
- Follow-up examination attendance was 76.7% for those referred; participants referred for glaucoma had a follow-up rate of 92%
- A total of 428 participants (85.8%) reported that they were very satisfied with the vision screening, 83.2% were very satisfied with the time for the complete screening, and 92.2% stated that it was very convenient having their ocular screening in the same clinic as their primary care provider

## CONCLUSIONS

- The high percentage of patients diagnosed with treatable eye conditions through the AL-SIGHT telemedicine screening and their strong adherence to follow-up eye care suggests that these screenings in FQHCs could be effective and scalable nationwide.
- Participants welcomed screenings in their communities.
- A strength of the AL-SIGHT program is its use of both structural and functional optic nerve testing. Although the reliability of the visual fields in this study was poor in ~34% of participants, this is in the range noted in other studies and reflects a cohort not considered to be experienced visual field test takers.

# Eye stroke protocol in the emergency department

**AUTHORS:** Bénard-Séguin É, Nahab F, Pendley AM, Rodriguez Duran M, Torres Soto M, Keadey M, Wright DW, Newman NJ, Biousse V.

**PUBLICATION:** J Stroke Cerebrovasc Dis. 2024 Jul 28;33(9):107895. doi: 10.1016/j.jstrokecerebrovasdis.2024.107895. Epub ahead of print.

## STUDY PURPOSE

To evaluate the use of non-mydriatic fundus photographs (NMFP) combined with OCT to facilitate ultra-rapid remote diagnosis and stroke alert for patients with acute vision loss presenting to the emergency department (ED)

## OVERVIEW



### STUDY DESIGN

Prospective evaluation of all central and branch retinal artery occlusions (CRAO and BRAO) between 06/06/2023-06/06/2024 who had NMFP-OCT imaging in Emory University's general ED affiliated with a stroke center



### STUDY DEVICE(S)

Maestro2 NMFP-OCT (Topcon, Japan)



### # OF EYES/PATIENTS

26 patients diagnosed with retinal artery occlusions (22 CRAOs and 4 BRAOs) in ED

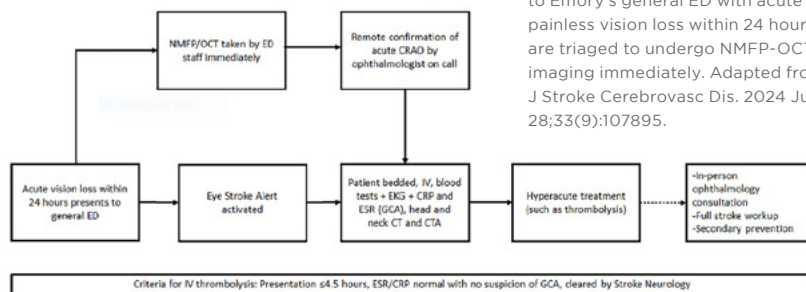


### OUTCOME MEASURES

Time between vision loss onset and presentation to ED, time and results of ocular imaging, quality of ocular imaging, and number of patients undergoing thrombolysis treatment

## RESULTS

- Five patients presented to ED within 4.5 hours of vision loss onset, six presented between 4.5 and 12 hours and 15 presented after 12 hours of symptom onset. On average, NMFP-OCT was performed within 141 minutes of presentation to ED (range 27-422 minutes)
- Of the nine patients who underwent NMFP-OCT imaging within 12 hours of symptom onset, 5 had subtle retinal whitening on color photographs consistent with acute ischemia but all showed inner retinal hyperreflectivity/edema on OCT
- Quality of color fundus photographs and OCT was good with average scores of 3.3/5 and 4.2/5, enabling diagnosis of acute CRAO or BRAO from 19 of 26 non-mydriatic color fundus photographs and 25 of 26 OCT images
- Diagnosis of acute RAO was made remotely with NMFP-OCT within 4.5 hours in 4 patients, 2 of whom received intravenous thrombolysis. All patients underwent a complete stroke workup while in the ED and were discharged home with appropriate secondary prevention of stroke (Figure 1)



**FIGURE 1** All patients presenting to Emory's general ED with acute painless vision loss within 24 hours are triaged to undergo NMFP-OCT imaging immediately. Adapted from J Stroke Cerebrovasc Dis. 2024 Jul 28;33(9):107895.

## CONCLUSIONS

- Implementation of Maestro NMFP-OCT in a general ED enables rapid remote diagnosis of retinal artery occlusions and facilitates initiation of an eye stroke protocol in acute patients before in-person ophthalmology consultation is performed
- OCT complements color fundus photography and provides greater diagnostic accuracy in hyperacute cases with near-normal appearing ocular fundi



## PEER-REVIEWED PUBLICATIONS

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### **Evaluating the impact of optical coherence tomography in diabetic retinopathy screening for an Aboriginal population**

O'Halloran RA, Turner AW

Clin Exp Ophthalmol. 2018 Mar;46(2):116-121. doi: 10.1111/ceo.13018.

### **Automated Identification of Referable Retinal Pathology in Teleophthalmology Setting**

Gao Q, Amason J, Cousins S, Pajic M, Hadziahmetovic M

Transl Vis Sci Technol. 2021 May 3;10(6):30. doi: 10.1167/tvst.10.6.30.

### **Use of Teleophthalmology for Evaluation of Ophthalmic Emergencies by Ophthalmology Residents in the Emergency Department**

Shah YS, Fliotsos MJ, Alaqeel A, Boland MV, Zafar S, Srikumaran D, Woreta FA

Telemed J E Health. 2022 Jun;28(6):858-864. doi: 10.1089/tmj.2021.0334.

### **Emergency Department Non-Mydriatic Fundus Photography Expediates Care For Patients Referred For “Papilledema”**

Lin MY, Ray H, Pendley A, Okrent Smolar AL, Duran M, Torres Soto M, Berman G, Bruce B, Wright D, Newman NJ, Biousse V. Invest. Ophthalmol. Vis. Sci. 2024;65(7):77.

# OCT

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# ANGIOGRAPHY

# Comparison of macular neovascularization lesion size by the use of Spectral-Domain Optical Coherence Tomography Angiography and Swept-Source Optical Coherence Tomography Angiography versus Indocyanine Green Angiography

**AUTHORS:** Haas AM, Ahmed D, Stattin M, Graf A, Krepler K, Ansari-Shahrezaei S.

**PUBLICATION:** Acta Ophthalmol. 2021 Mar;99(2):e260-e266. doi: 10.1111/aos.14572. Epub 2020 Aug 24.

## STUDY PURPOSE

To compare the lesion sizes of macular neovascularization (MNV) imaged with spectral-domain (SD), swept-source (SS) optical coherence tomography angiography (OCTA), and indocyanine green (ICGA)

## OVERVIEW



### STUDY DESIGN

Prospective, observational case series



### STUDY DEVICE(S)

Maestro2 SD-OCTA (Topcon Corporation, Tokyo, Japan)  
Triton™ SS-OCTA (Topcon Corporation, Tokyo, Japan)  
Spectralis® HRA, Heidelberg, Germany)



### # OF EYES/PATIENTS

Twenty eyes from 20 patients with type 1, 2 or mixed type MNV secondary to age-related macular degeneration (AMD)



### OUTCOME MEASURES

Primary outcome measure: comparison between MNV area in 6x6 mm<sup>2</sup> images on SD-OCTA and SS-OCTA

Secondary outcome measures: comparison of 3x3 mm<sup>2</sup> images between the SD-OCTA and SS-OCTA, between OCTA and ICGA images, and sensitivity of both OCTA devices

## RESULTS

- On 6x6-mm<sup>2</sup> scans, SS-OCTA showed larger lesion sizes for MNV that were fully outlined compared to SD-OCTA ( $p = 0.094$ ). Differences between SD-OCTA and ICGA measurements ( $p = 0.057$ ) and SS-OCTA and ICGA lesion sizes ( $p = 0.274$ ) were not significant
- On 3x3-mm<sup>2</sup> images, comparable MNV area sizes were measured between the two OCTA devices ( $p = 0.492$ ) and no statistical significance was detected comparing SD-OCTA with ICGA ( $p = 0.278$ ) and SS-OCTA with ICGA ( $p = 0.492$ )
- Within the same OCTA device (Maestro2 or Triton), no statistical difference could be shown for MNV lesion size between 3x3-mm<sup>2</sup> and 6x6-mm<sup>2</sup> scans
- Neovascular network was not detected in seven patients on SD-OCTA and three patients on SS-OCTA, while the presence of neovascularization was confirmed by ICGA in 100% of eyes. Hence, detection rate was 13/20 (65% sensitivity) for SD-OCTA and 17/20 (85% sensitivity) for SS-OCTA

## CONCLUSIONS

- Compared to SD-OCTA, SS-OCTA may show larger areas of macular neovascularization extensions and better correlation to ICGA
- The high identification of neovascular membranes on OCTA reduces the need to use FA and ICGA in clinical practice, reserving dye-based angiography for select patients, such as people with low visual acuity, bad fixation, or inconclusive OCTA findings

# Robotic Spectral-domain versus Swept-source OCT in the association between OCT-Angiography metrics and glaucoma severity

**AUTHORS:** Fazio MA, Clark ME, Girkin CA

**PUBLICATION:** Invest. Ophthalmol. Vis. Sci. 2024;65(7):1212.

## STUDY PURPOSE

To assess the association between OCT-Angiography (OCTA) metrics and glaucoma severity in subjects imaged by a Spectral-domain (SD) robotic OCT and a swept-source (SS) OCT

## OVERVIEW



### STUDY DESIGN

Prospective, observational



### STUDY DEVICE(S)

Maestro2 SD-OCT (Topcon Healthcare, Tokyo, Japan)  
Triton SS-OCT (Topcon Healthcare, Tokyo, Japan)  
\*investigational OCTA acquisition software



### # OF EYES/PATIENTS

Thirty-four eyes of 26 glaucoma subjects



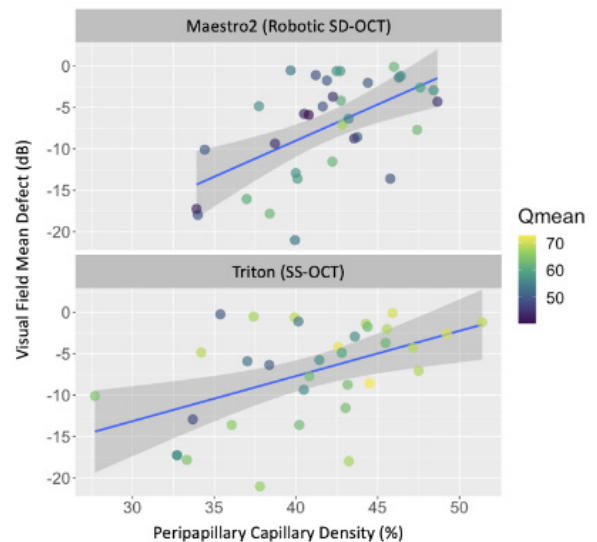
### OUTCOME MEASURES

Linear correlation between radial peripapillary capillary vessel density and visual field mean defect (MD)

## RESULTS

- Radial peripapillary capillary density showed significant association with VF MD for both robotic SD-OCT (2.067 dB/%,  $p=0.001655$ ) and SS-OCT (1.94 dB/%,  $p=0.004026$ ); both associations were independent of layer thickness
- Strength of the correlation was higher for the SS-OCT ( $R^2=0.54$ ) than the SD-OCT ( $R^2=0.45$ ) (Figure 1)

**FIGURE 1** Linear correlation between radial peripapillary capillary vessel density and visual field mean defect (MD). Scatterplots are color-coded by scan quality's native score (Q-mean). Adapted from Invest. Ophthalmol. Vis. Sci. 2024;65(7):1212.



## CONCLUSIONS

- Investigational OCTA metrics by Maestro2 (robotic SD-OCT) performed comparably with the Triton's (SS-OCT) OCTA metrics in their association with glaucoma severity
- The highly automated capabilities of the Maestro2's OCTA may make it a valuable tool for primary eye care and population screening programs

# Microaneurysms Detection by Two Optical Coherence Tomography Angiography Devices

**AUTHORS:** Alibhai AY, Steffens T, Hou H, Durbin M, Waheed NK.

**PUBLICATION:** Invest. Ophthalmol. Vis. Sci. 2024;65(7):5529.

## STUDY PURPOSE

To evaluate detection of microaneurysms (MAs) in healthy and diseased eyes by two different OCTA devices, using fluorescein angiography (FA) as the gold standard

## OVERVIEW



### STUDY DESIGN

Prospective



### STUDY DEVICE(S)

Cirrus®  
(Zeiss, Dublin, CA)  
Maestro2  
(Topcon Healthcare,  
Tokyo, Japan)



### # OF EYES/PATIENTS

38 healthy eyes and 86  
pathologic eyes, including  
diabetic retinopathy  
(DR), branch retinal vein  
occlusion, and exudative  
age-related macular  
degeneration



### OUTCOME MEASURES

Positive percent agreement (PPA), or proportion of eyes with the OCTA showing microaneurysms (MAs) given the corresponding FA showed MAs; negative percent agreement (NPA), or proportion of eyes with the OCTA showing no MAs given the corresponding FA showed no MAs

## RESULTS

- For healthy eyes, FA detected MAs in a few eyes, while OCTA observed none, meaning PPAs for the two devices and the three scan types were zero. The NPA were all 100%, except one macula 6mm x 6mm scan on the Cirrus revealed a false positive detection in one eye, reducing the corresponding NPA to 96.9%
- For the eyes with pathology, the PPAs for MAs were all above 95% for the macular scan types on both OCTA devices and 73.9% and 70.0% for the disc scan for the Maestro and Cirrus, respectively. For both OCTA devices and all three scan types, the NPA ranged from 92.7% to 100% in eyes with pathologies

## CONCLUSIONS

- No significant difference was seen between Maestro and Cirrus OCTA in identifying MAs. When comparing to the clinical gold standard FA, both had excellent performance in identifying MAs on or around the macula
- The disc scan on both devices showed comparatively lower detection of MAs, suggesting that known limitations of OCTA technology, such as projection artifacts from the presence of bigger vessels, are more likely to obscure the identification of MAs in the circumpapillary area

