

Salient Features

A unique audio-visual educational module for training of general ophthalmologists on the use of Optical Coherence Tomography (OCT) in Glaucoma prepared by a team of national and international glaucoma experts.

Includes :

- Basic Principles Of OCT
- Why Do We Need OCT
- How To Evaluate An OCT Scan
- OCT For Structure And Progression Analysis
- Artefacts In Imaging
- How To Distinguish Myopia From Glaucoma
- Non-glaucomatous Atrophy
- Role Of OCT Angiography
- OCT-Guided Surgery
- Taking Care Of OCT Machines
- Case Studies
- Anterior Segment OCT
- Imaging In Angle Closure
- Using OCT - Key Take Home Messages

Terms of Use

Aim of these guidelines is to assist the ophthalmologist in the management of glaucoma patients.

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Joint initiative of
All India Ophthalmological Society (AIOS)



& **Cipla**

OCT: Optical Coherence Tomography

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Optical Coherence Tomography in Glaucoma

Editor

Dr. Tanuj Dada

MD, FRCSEd
Professor and Head of Glaucoma Services

Associate Editors

Dr. Anand Naik Bukke
MD

Mr. Ajay Sharma
M Optom

Mr. Ashok Kumar Maurya
B Optom

**Dr. Rajendra Prasad Centre for Ophthalmic Sciences
All India Institute of Medical Sciences,
New Delhi**

OCT in Glaucoma

*IMS Nov 2022
#compared to other marketed formulations
CAI, Carbonic anhydrase inhibitor; IOP, Intraocular pressure
References:
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Lower Parel, Mumbai - 400013, India.
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Editorial Committee

Tanuj Dada, Anand N Bukke, Ajay Sharma and Ashok K Maurya

Foreword

Dear Friends,

Making an early diagnosis of glaucoma is essential to preserve the vision-related quality of life in glaucoma patients. In recent years, OCT has become an important tool in the diagnosis & management of glaucoma patients and is increasingly being used in ophthalmic clinics. However, performing the appropriate scan protocol, imaging the correct structure and interpreting the image are quite challenging and require optimal training which is often lacking in regular academic programs. It is very important for the trainee/general ophthalmologists to know when to do OCT, which protocol to use and how to decipher useful information which can be put to use in guiding patient care.

There is an unmet need for educating the ophthalmic community on the rational use of OCT for glaucoma, to optimize its use for glaucoma diagnosis and at the same time minimizing unnecessary imaging when it is not required.

We are very happy to present this educational audio-visual module on OCT in glaucoma with a team of renowned national and international glaucoma experts. This module covers basic concepts of OCT, types of imaging protocols available, pitfalls in deciphering OCT images, distinguishing glaucoma from non-glaucomatous optic atrophy and includes several illustrative case studies. Recent advances in OCT imaging including OCT angiography and OCT-guided glaucoma surgery are also included.

We are sure that this initiative will help ophthalmologists in upgrading their skills in diagnosing and treating glaucoma and ultimately help in improving the standard of care of glaucoma patients.

Dr. Namrata Sharma
Hony. General Secretary, AIOS

Dr. Lalit Verma
President, AIOS



All India Ophthalmological Society (AIOS)

Pearls and Pitfalls on using OCT in Glaucoma

Dr. Tanuj Dada

Key Messages

1. Use OCT as a tool to support your clinical examination and not to bypass it.
2. Making a diagnosis of glaucoma requires detection of retinal nerve fiber layer defect and focal defects in the neuro-retinal rim which requires a dilated stereoscopic examination of the fundus.
3. Taking a fundus photograph (colour and red-free) and spending time to study the features of the optic nerve head and retinal nerve fiber layer is essential and should be done for all cases of suspected or confirmed glaucoma at each follow-up. Picking up pallor of the neuro-retinal rim and disc haemorrhages is important.
4. Some OCT machines give a multicolour image of the fundus with blue and green reflectance, and these are very useful to pick up abnormalities in the retinal nerve fiber layer (RNFL) and should be the first step in interpreting the OCT. Blue reflectance images are especially helpful to delineate RNFL defects in eyes with chorio-retinal degeneration.
5. The main utility of OCT in a routine clinic is to rule out glaucoma in eyes with a large cup-disc ratio and suspicious disc appearance. A high-quality scan showing normal OCT with healthy RNFL- Neuroretinal Rim (NRR)- Ganglion Cell Complex (GCC) has a very high specificity to rule out glaucoma. The OCT is also a great asset in patients who cannot perform a reliable perimetry.
6. If the OCT scan gives borderline results and you are not sure of the diagnosis, always follow-up the patient and redo the scans every 4-6 months. If there is progression of RNFL/NRR/GCC confirmed across a minimum of 2 scans and supportive clinical examination, a diagnosis of glaucoma can be confirmed.

Pearls and Pitfalls on using OCT in Glaucoma

7. The numerical values in the OCT scan are colour coded to compare the patient against a normative database. Never start treatment based solely on red parameter values in a single scan as these just indicate that patient is outside the normative database and does not indicate glaucoma. There can be several causes for an abnormal scan including artefacts, neuro-ophthalmic / retinal disorders in addition to glaucoma.
8. Glaucoma occurs due to apoptosis of retinal ganglion cells. The ganglion cell has 3 basic components - cell body (GC), dendrites (IPL-inner plexiform layer) and axon (RNFL). Initial damage can occur either in the cell body (picked up as GC) or GC-IPL defects or the axon (picked up as RNFL defects). Therefore, it is essential to image both RNFL and Macula (Ganglion cell layer-GCL).
9. Wide scans are now available which capture both optic nerve-RNFL and macula in a single scan and are better for topographic diagnosis of glaucoma as compared to separate scans of optic nerve and macula.
10. In some patients, RNFL defects precede defects in GCL and in others, GCL defects precede RNFL defects (more common in normal pressure glaucoma). Both precede defects on perimetry.
11. The best way to diagnose glaucoma on OCT is to look for concurrent defects in the RNFL-Neuro-retinal rim tissue (also called BMO-MRW) and GCL.
12. Earliest defects are seen in the macular vulnerability zone (infero/supero Temporal RNFL and temporal macula for GCL-respecting the horizontal meridian)

Pearls and Pitfalls on using OCT in Glaucoma

13. A high percentage of OCT scans may have artefacts which can lead to under/over estimation of RNFL thickness. Before interpreting a scan printout, look at the actual scan and RNFL boundary on the OCT machine monitor. Check if the signal strength value is appropriate for the machine and check for media opacities (cataract, posterior capsule opacification, dry eye, etc). Retinal pathologies affecting the macula and peripapillary region (ARMD, CME, etc) should be ruled out.
14. In myopia, the RNFL bundles are often shifted temporally and also the scan circle is further away from the optic disc and this may give a false positive scan. The GCL and NRR changes are more important in such cases.
15. Focus on the total thickness maps as these are independent of the normative database. Always compare superior vs inferior RNFL and right vs left eye to see for early damage. See for concurrence between thickness and deviation maps. Like the visual field glaucoma hemifield test, macular retinal thickness hemisphere asymmetry gives an important indication for glaucoma damage.
16. Do not interchange OCT machines from different manufacturers during follow-up of a glaucoma patient as different algorithms are used for each. You can export old images to a new version of the OCT machine from the same company and use it.
17. Although the main utility of OCT lies in the diagnosis and follow-up of eyes with ocular hypertension or early glaucoma, it can be used to monitor progression in eyes with moderate-advanced glaucoma using the Ganglion cell layer imaging as RNFL has already reached the floor and will not be useful in such cases. However, evaluating progression and modifying treatment in eyes with moderate-advanced glaucoma is best done with standard automated perimetry.
18. You may have missed an RNFL/NRR defect on clinical exam. If the OCT shows a defect, go back and carefully examine the fundus in the same location to confirm the defect. This is an important part of training to improve your clinical skills.

Pearls and Pitfalls on using OCT in Glaucoma

19. In eyes with peri-papillary atrophy or large myopic discs, the diameter of the scan circle for RNFL can be increased so that it does not include the pathological area. Evaluation of myopic eyes remains a challenge and ideally requires comparison against a myopic data base. If RNFL / GCC scans are not reliable, the width of the neuro-retinal rim serves as an important landmark for diagnosis and to follow-up for progression.
20. When you follow-up a patient over a long period of time, there is an age-related loss of RNFL (approx. 0.5 $\mu\text{m}/\text{year}$ for average RNFL thickness and 1.25 $\mu\text{m}/\text{year}$ loss for superior and inferior RNFL thickness). The diagnosis of glaucoma progression should only be made if the loss of RNFL is more than double of the expected age-related loss.
21. Use the OCT to complement your clinical exam, provided you know how to use it and when to discard artefactual information.
22. Do not start / change treatment-based OCT scan alone. Look at the complete clinical picture with risk factors, intraocular pressure (IOP), central corneal thickness (CCT), family history, pseudoexfoliation (PXF), perimetric changes and clinical changes in RNFL/optic nerve. Always make the patient a partner in decision making for starting /escalating treatment after discussing the OCT/ visual field (VF) printouts.
23. OCT angiography and its algorithm is still evolving and there is no need to incorporate disc / macula angiography in routine work-up of glaucoma patients at present.
24. Wide field scanning with swept-source OCT with overlay of vasculature changes and RNFL optical texture analysis (ROTA) are exciting advances which have the potential to improve the detection of glaucoma in the near future.

Contributors

Dr. Barun Nayak

Dr. Ronnie George

Dr. Dewang Angmo

Dr. S S Pandav

Dr. Gowri Murthy

Dr. Sachin Dharwadkar

Dr. Harsha Rao

Dr. Sirisha Senthil

Dr. Murali Ariga

Dr. Sushmita Kaushik

Dr. Rohit Saxena

Dr. Tanuj Dada

INTERNATIONAL SPEAKERS

Dr. Pradeep Ramulu

Dr. Tin Aung

Dr. Ki Ho Park

Dr. Alon Harris

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OCT in Glaucoma



Dr. Barun Nayak

MBBS, MD (Ophthal), MNAMS (Ophthal), DO (London), Fellow Retina & Vitreous Surgery (Australia)
PD Hinduja Hospital & Medical Research Centre
Head of Department of Ophthalmology, Mumbai

HOW I USE OCT



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Dr. Sachin Dharwadkar

DO, DNB, FRCS (Glasgow)
Consultant Glaucoma surgeon, P.D .Hinduja hospital and medical research centre, Mumbai
Director, Samartha speciality clinics, Mumbai

BASIC PRINCIPLES OF OCT



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Dr. Ronnie George

DO, DNB, MS
Director, Glaucoma Services
Sankara Nethralaya, Chennai

WHY DO WE NEED OCT?



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Dr. Harsha Rao

MS, DNB, PhD
Consultant, Department of Glaucoma
Narayana Nethralaya, Bengaluru

HOW TO EVALUATE AN OCT SCAN



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OCT in Glaucoma



Dr. Pradeep Ramulu

MD, MHS, PhD
Sheila K. West Professor of Ophthalmology
Director, Glaucoma Center of Excellence
Wilmer Eye Institute, Johns Hopkins, USA

OCT FOR STRUCTURE AND PROGRESSION ANALYSIS



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Dr. Gowri Murthy

MBBS, DO, DNB, FRCO (Lon) , FRCS (Edin)
Senior consultant,
Glaucoma and Cataract
Prabha eye clinic and research Centre, Bengaluru

ARTEFACTS IN IMAGING



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Dr. Ki Ho Park

MD, PhD
Professor of Ophthalmology
Seoul National University
South Korea

HOW TO DISTINGUISH MYOPIA FROM GLAUCOMA



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Dr. Rohit Saxena

Prof., MD, PhD.
Dr. Rajendra Prasad Centre for Ophthalmic Sciences,
All India Institute of Medical Sciences, New Delhi

NON-GLAUCOMATOUS ATROPHY



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OCT in Glaucoma



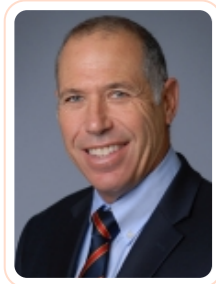
Dr. S S Pandav

MS
Professor of Ophthalmology
HOD- Advanced eye Centre, P.G.I.M.E.R,
Chandigarh

ROLE OF OCT ANGIOGRAPHY



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Prof. Alon Harris

MS, PhD, FARVO
Professor of Ophthalmology
Vice Chairman of International Research and
Academic Affairs
Director of Ophthalmic Vascular Diagnostic and
Research Programs
Mount Sinai Hospital, NY, USA

OCT-A FOR DETECTING OBF



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Dr. Dewang Angmo

MD (AIIMS), DNB, FRCS, FICO, MNAMS
Associate Professor of Ophthalmology
Dr. Rajendra Prasad Centre for Ophthalmic Sciences, AIIMS,
New Delhi

OCT-GUIDED SURGERY



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Dr. Murali Ariga

MS, DNB, FAICO (Glaucoma), PGDMLE
(National Law School Bengaluru)
Director and Senior Consultant, Swamy Eye Clinic, Chennai
Head- Department of Ophthalmology
Sundaram Medical Foundation, Chennai

TAKING CARE OF OCT MACHINES



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OCT in Glaucoma



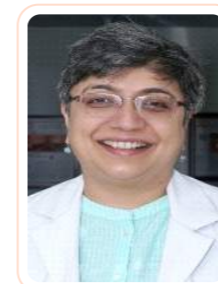
Dr. Sirisha Senthil

MS, FRCS (Edinburgh)
Head of VST Centre for Glaucoma Care,
LV Prasad Eye Institute, Hyderabad

CASE STUDIES



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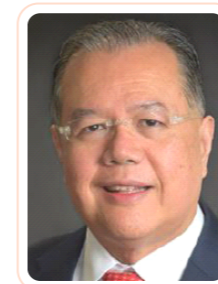
Dr. Sushmita Kaushik

MS, FAICO
Advanced eye Centre
Professor- Glaucoma Services
Post-graduate Institute of Medical Education and Research,
Chandigarh

ANTERIOR SEGMENT OCT



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Dr. Tin Aung

FRCS(Ed), FRCOphth (UK), MMed (Ophth) (Singapore),
FAM (Singapore), PhD (London)
Chief Executive Officer, Singapore National Eye Centre
Singapore

IMAGING IN ANGLE CLOSURE



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Dr. Tanuj Dada

MD, FRCS
Professor and Head of Glaucoma Service
RP Centre for Ophthalmic Sciences
All India Institute of Medical Sciences
New Delhi

USING OCT - KEY TAKE HOME MESSAGES



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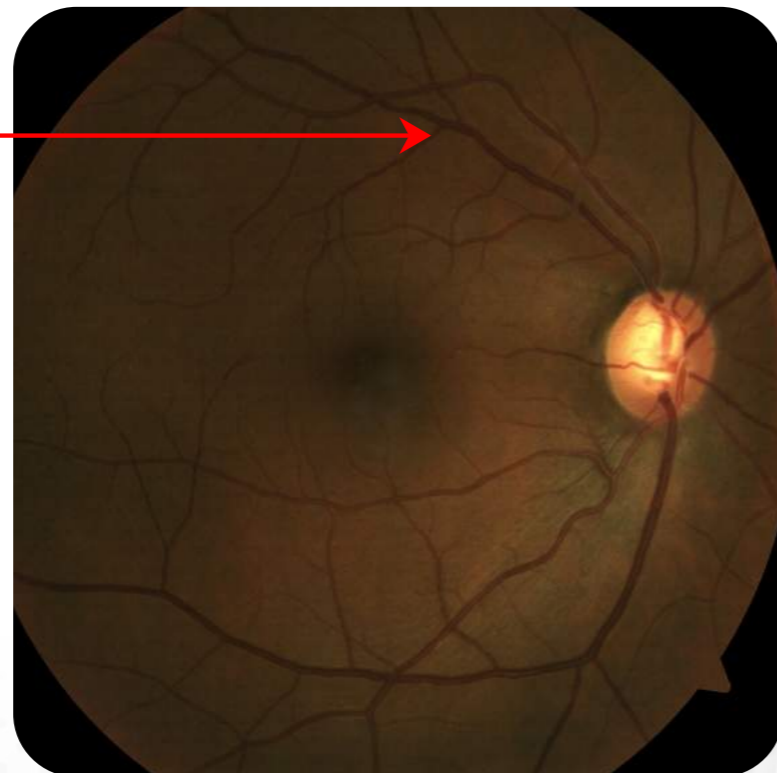
Case Study

A typical case of glaucoma with supero-temporal RNFL defect and notching of the superior neuro-retinal rim is visible on colour and black and white fundus photographs. Multi-colour image of OCT confirms well demarcated superior RNFL defect.

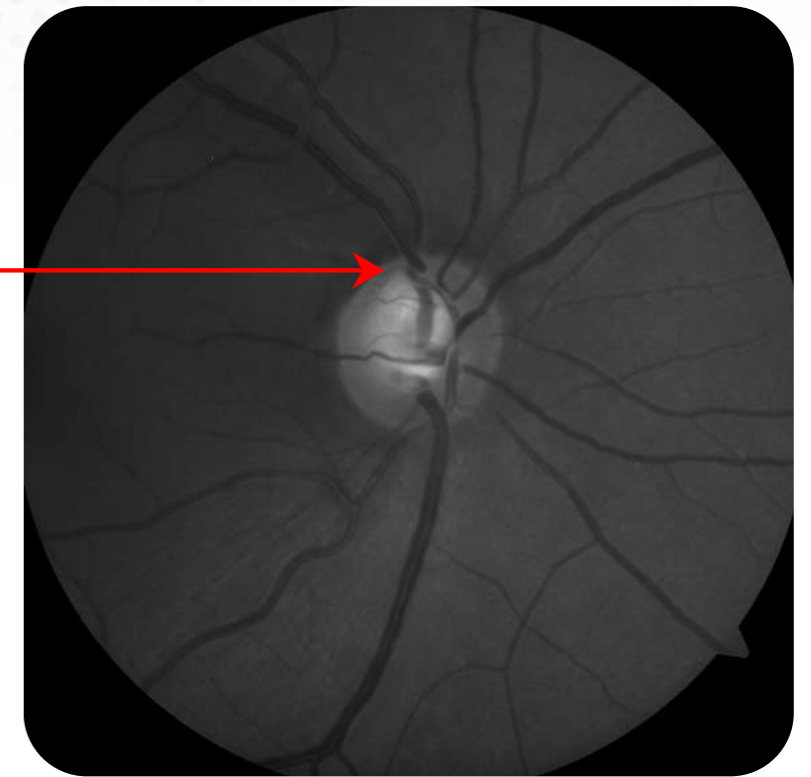
The RNFL scan around optic disc is well centered and RNFL boundary is correctly identified.

Cirrus PanoMap incorporating both disc and macula confirms the presence of superior RNFL defect along with temporal Ganglion cell layer (GCL) loss in the superior temporal quadrant. Spectralis scan shows corresponding defects in superior neuroretinal rim (MRW)- superior RNFL thinning - superior thinning and hemisphere asymmetry on total macular thickness scan and specific Ganglion cell loss in superior-temporal region. There is corresponding inferior arcuate defect on the visual field confirming a typical structure-function loss which is diagnostic of glaucoma.

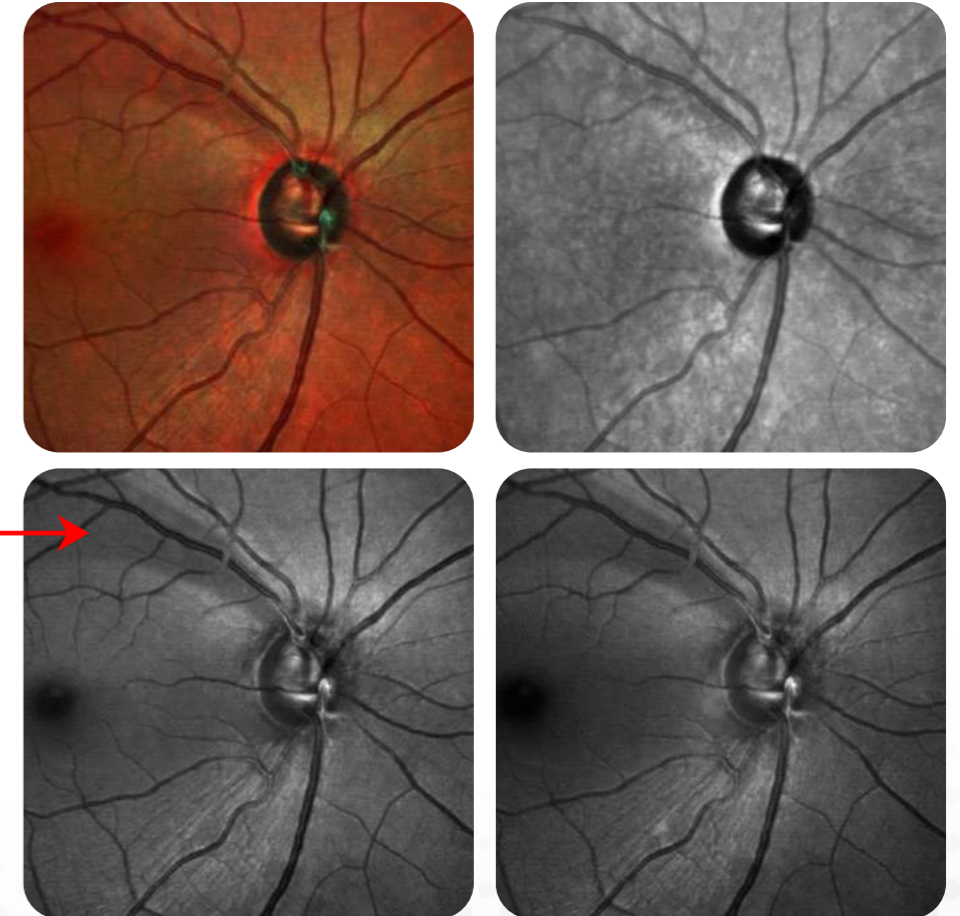
Superior wedge-shaped RNFL defect visible on colour fundus photo



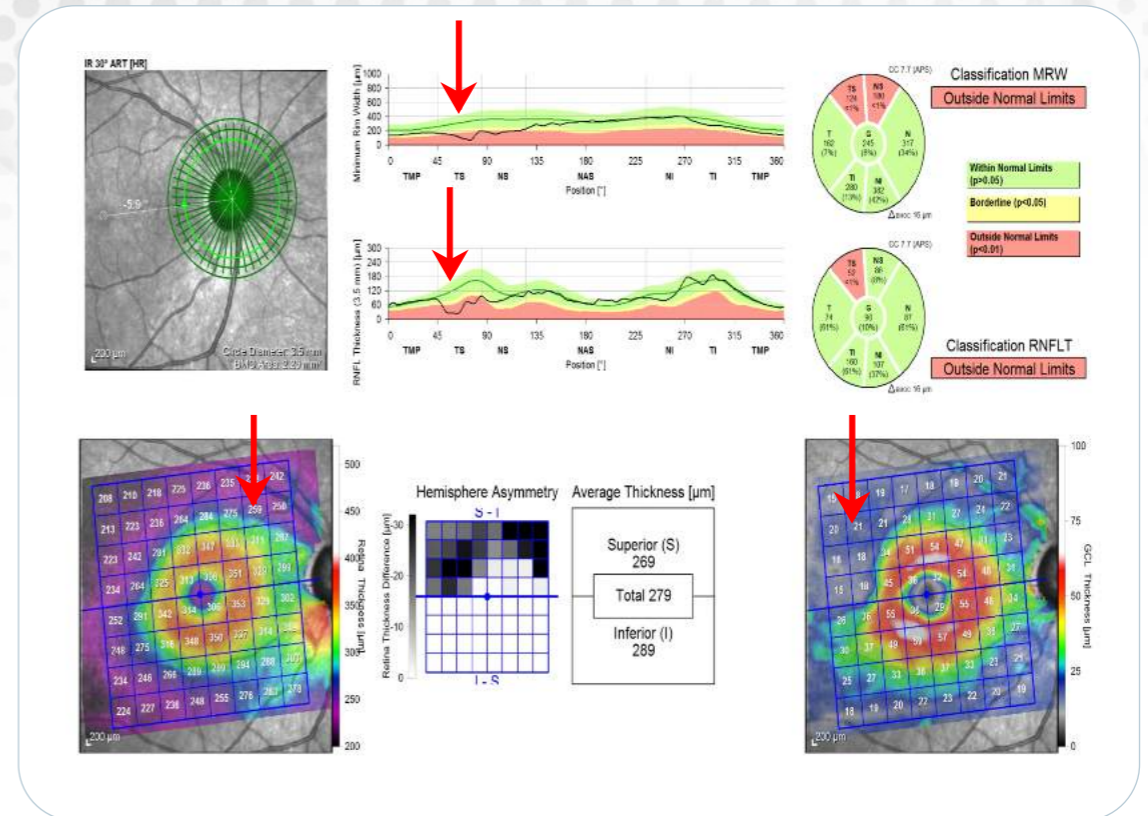
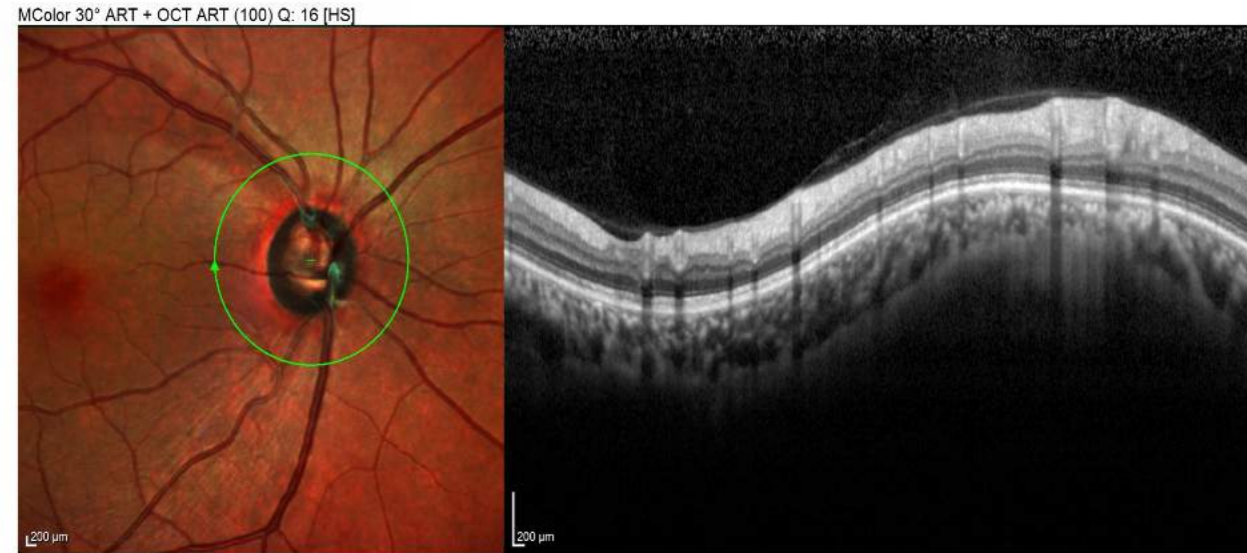
Superior wedge-shaped RNFL defect and notching of superior neuro-retinal rim visible on red-free fundus photo



Superior wedge-shaped RNFL defect clearly identified in multi-colour fundus photo on the Spectralis OCT machine

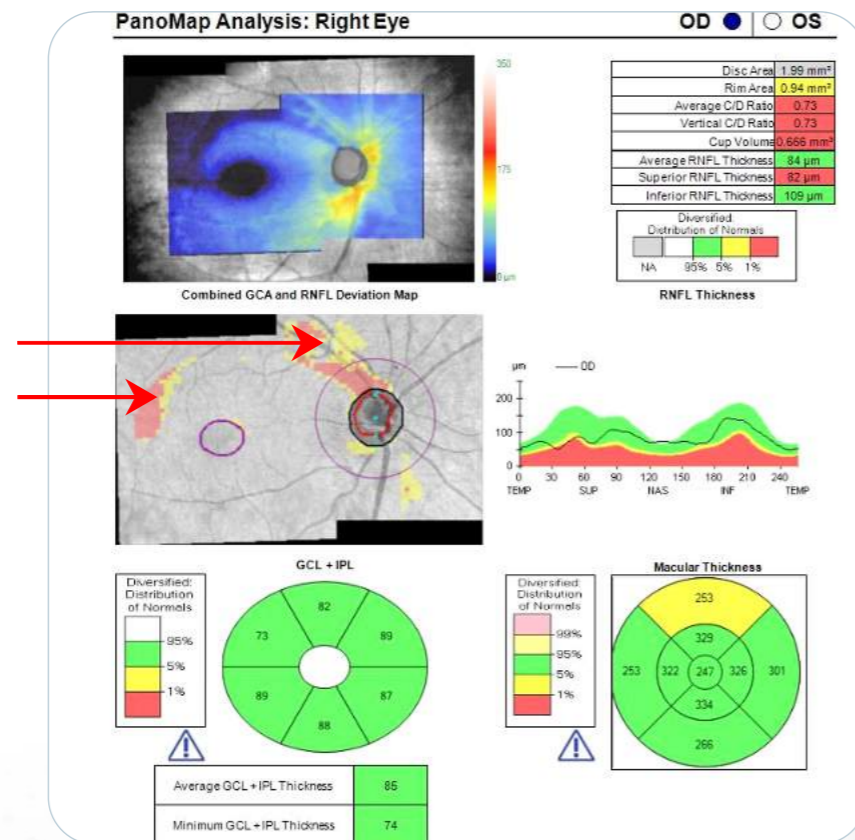


Well Centered Scan with correct identification of RNFL boundary

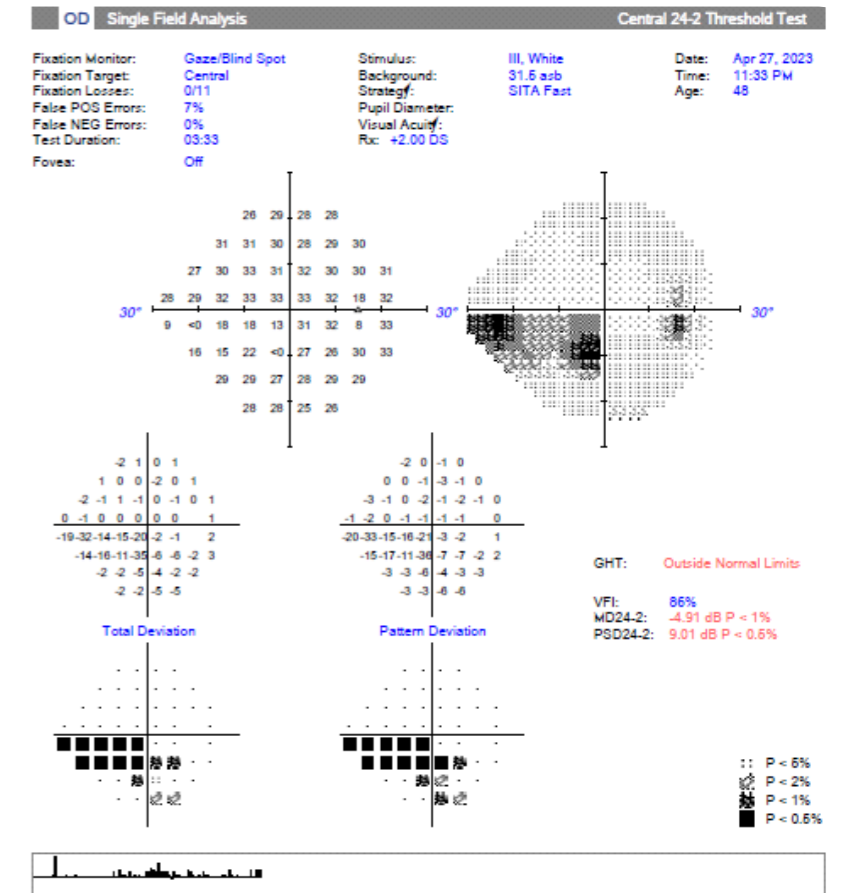


Spectralis scan shows corresponding defects in superior neuro-retinal rim (MRW)- superior RNFL thinning - superior thinning and hemisphere asymmetry on total macular thickness scan and specific Ganglion cell loss in superior-temporal region.

Combined RNFL and Macula GCA report - Panomap Analysis on Cirrus OCT showing superior RNFL defect and GCL defect visible on thickness and deviation maps



24-2 SITA FAST Humphrey Visual Field showing inferior visual field defect correlating with changes in superior - neuroretinal rim, RNFL and Ganglion cell loss





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*IMS Nov 2022
CAI: Carbonic anhydrase inhibitor; IOP: Intraocular pressure
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