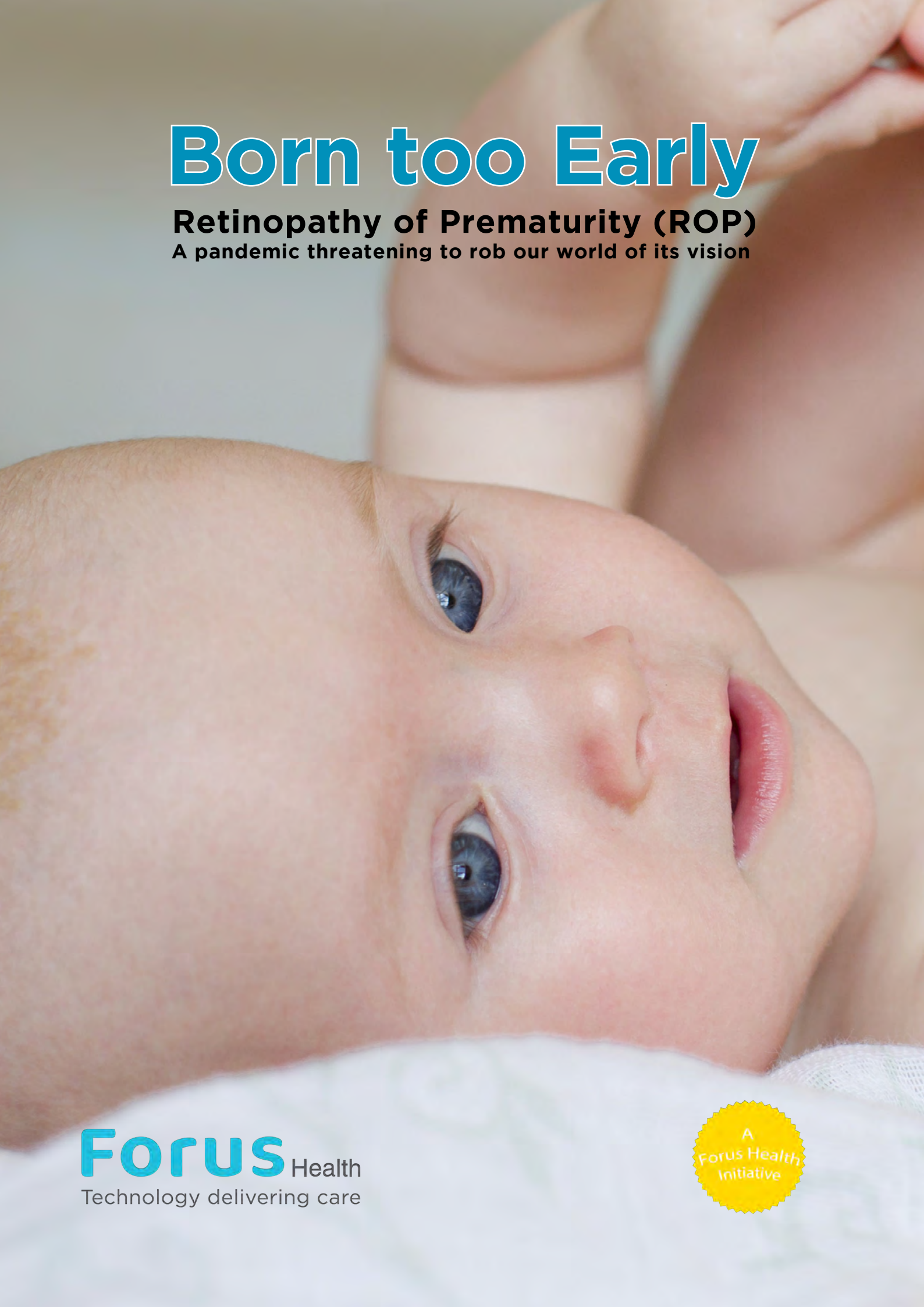


Born too Early

Retinopathy of Prematurity (ROP)

A pandemic threatening to rob our world of its vision

Forus Health

Technology delivering care

A Forus Health Initiative

3nethra neo

3nethra neo HD FA

Forus Health
Technology delivering care

Product or Service innovations are of no significance if not put to use. We would like to share 30+ fascinating case studies that have deeply inspired us. We are very happy to share how organizations and clinical care specialists have relentlessly worked on screening and treatment of ROP using innovative last mile reach models.

They have consistently proved that these models are sustainable, scalable and with phenomenal repeatability for ROP screening and treatment.

We have seen several models emerge globally in ROP screening such as. Ophthalmologists lead screening, Technician lead screening, Hybrid screening for outreach and NICU lead model in Hospitals.

We are sure that these stories will touch your hearts, their impact will motivate and inspire you. We also strongly believe that these case studies will inspire ophthalmologists across the world to take up ROP screening in their respective locations thereby playing a significant role in preventing ROP blindness.

Economic impact of ROP blindness prevented in these 30 case studies alone is a mind boggling 2.5 B USD. This impact has been calculated as a multiple of per capita GDP of a country and the number of productive years of life expectancy.

Forus Health is extremely happy to have innovated 3nethra neo & 3nethra neo HD FA enabling ROP specialists globally help build sustainable, scalable ROP screening models. Forus Health is humbled to be part of this wonderful and inspiring journey of our lives.

K Chandrasekhar
Founder & CEO
Forus Health Pvt Ltd

Forus Health is deeply privileged to work with some of the leading pediatric retina doctors and organizations in our mission of preventing ROP blindness in infants globally.

Economic Impact of ROP Blindness Burden Saved **=**
No. of babies treated x **X** x **Y**

X	**Productive life years**
Y	Per capita GDP of a country in USD
Productive life years	Life expectancy - 20 years

* Life expectancy for Indians is 70 years
* Per capita GDP for India is 2274 USD
(world bank data)

Table of Contents

Image Credits

Case Studies, Image Atlas

Content Credits

All photos and content credits are to respective hospitals.

Image Atlas credits

- Aravind Eye Hospital-Chennai, Madurai
- Forus Health Pvt Ltd
- LV Prasad Eye Institute-Hyderabad, Bhubaneswar, Vijayawada.
- Narayana Nethralaya-Bangalore
- Sankara Nethralaya - Chennai
- Hospitals across Mexico, Spain, Italy, UK, Eastern Europe.

“

“ There’s nothing I don’t love about the camera.

What more can I ask for! ”

Pg: 102

The need of the hour

The need of the hour is an affordable, high quality wide-field imaging solution to screen, evaluate, and photo-document pediatric ocular diseases to prevent blindness in newborn babies.

Pg: 12

3nethra neo

3nethra neo

120 FOV, Wide field Imaging, 4MP, Integrated FH Telecare

Pg: 14

3nethra neo HD FA

3nethra neo HD FA

150 FOV, Wide field Imaging with FA, 20MP, Integrated FH Telecare

Pg: 16

Foreword

Dr. Rajvardhan Azad

Any compendium carries the ethos and morals of the content contained therein. It's a birds eye view of effort and innovation and its impact on our social order,quality of life. India is a country of diversity of health care spread over from rural to urban population.

Future of any country is dependent on younger generation, their quality of life and productivity. Retinopathy of prematurity ROP is one wherein future of young generation especially children is dependent.

ROP is a blinding disease least to say is preventable but it needs timely detection and management. Every year almost 2-3 lakhs infants fall into this net in India and leave alone the world. Indian ROP Society was born in 22 July 2016 at Bangalore keeping this startling figures in mind. While our society is involved in regular meetings and training of new ROP experts, the ophthalmic industry in India has to new age. A remarkable achievement is made by Forus Health a Bangalore based innovation centre who have come up with Pediatric fundus camera which was hitherto not manufactured in India. Forus Health provides an economical yet good quality camera which has become a ubiquitous tool for imaging in small infants and children all over the world.

Being associated with ROP movement for more than 25 years, I see great impact of these innovation on ROP care and prevention of blindness in children in India and globally.

I hope this compendium provides insight into the various important aspects of ROP and will be of great information for generalist and specialist alike.

Sincerely,

Dr. Rajvardhan Azad

President, Indian ROP Society

Chairman, University Service commission, Bihar,India
Professor Emeritus, Regional Institute of Ophthalmolgy, IGIMS, Bihar,India
Secretary,SAARC Academy of Ophthalmology
Chairman, Ophthalmic Education committee, Asia Pacific Academy of Ophthalmology
Ex Chief, Dr R P Centre, AIIMS, New Delhi

Dr. Subhadra Jalali

LVPEI
So that all may see
LV Prasad Eye Institute

Retina remains a beautiful but aloof, hidden from view, vital sensory part of our eye, where 'vision' is generated. Newborn eye diseases of the retina, that are potentially blinding have largely remained unknown both to doctors and parents due to barriers in 'seeing' the health and diseases of the retina. Foremost of these diseases is Retinopathy of prematurity (ROP) primarily affecting babies 'born too early'. As a result, it is not uncommon to see babies go blind due to lack of awareness, improper advice, lack of objective documentation and difficulty in meaningful cross consultation with experts. Viewing photographs of the retina of a newborn, captured safely and effectively, especially in those in critical care, hence becomes one of the vital links between the disease inside a child's eye and the treatment or advice to be given by health care providers to parents who will understand this problem and be compliant to the advice.

There are scores of cameras for adult retinal imaging but very few for newborns. The few available have either been way too expensive or too large to be transported readily or quite challenging to be used by an ordinary technician or non-retina specialists. Wide field imaging with high resolution is also missing in most. A compendium or an atlas showcasing various pathologies from different ethnicities and global shared expertise in the field is singularly absent.
My personal association with Forus Health Pvt. Ltd, Bengaluru started as an expert sent by Department of biotechnology under the SBIRI scheme (The Small Business Innovation Research Initiative) to visit them in the year 2012.

After Forus Health launched its portable adult fundus camera, it was quite logical for them to take up an even bigger challenge of making a fundus camera for the tiny eyes of newborn babies. India has the largest numbers of newborns and premature born babies in the world. Finding technological solutions to their problems was enabled by the huge young tech-savvy talent pool in India, especially in the city of Bengaluru where the camera was designed. They did not 'copy-paste' but came out with extensively researched product design with unique liquid lens based focusing mechanism and unique design for illumination. At every step, this was supported by the large clinical expertise in the area of ROP and other newborn eye and fundus disorders seen in India. During prototyping, my small contribution went into discussions about designing of a compact transport box 'that will fit into overhead luggage compartment' of an aircraft and that can be carried around easily by our nimble nursing staff. Forus Health came up with the final product having so much more. The high-quality photographs of retina in this compendium have hence emerged from a close coordination between the expertise of highly experienced ROP care specialists and the technology team at forefront of innovative solutions connected to our own ground realities.

When the parents, extended family, trainees, and clinician making critical treatment decisions, view the same image of retina of a baby together, then its clinical, educative, socioeconomic, and public health impact are substantive. The true value of 3nethra neo keeps evolving since its launch 6 years ago. Value addition with Fluorescein angiography is now launched in the year 2021 and is helping evaluate disease and its response and is now an indispensable tool in anti-vegf treatment era.

Amazing photographs are now being captured by retinal specialists and technicians and nurses, that give meaningful information about the pathology. The 'born too early' compendium provides valuable range of experience that has been gathered by front line experts who have imaged the newborn retina over the 5+ years exploring and using 3Nethra neo to its full advantage.

This 'born too early' compendium has arrived timely so that the experience of many expert and novice users is compiled for benefit of larger group of health care providers. This compendium has images that provide insights into retinal pathology of ROP at various time points in this rapidly changing and diverse dynamic disease. This compendium also provides access to disease pathologies beyond ROP and will be very useful to practitioners when confronted with unusual signs in the retina. While the disease focus remains 'ROP" additional critical blinding diseases are also included in the compendium that users have been discovering and documenting its usefulness. This includes a variety of disorders of eyes of newborns ranging from FEVR, neonatal tumors, TORCH infections, developmental anomalies, trauma and numerous rare diseases the list goes on. With the 3nethra neo imaging device gaining approval for sales in USA, Europe, Canada, UK and expanding in the Asian and African regions, this 'Born too Early' compendium provides a glimpse of some of these conditions from different parts of the world with images of different ethnicities. This opens a whole new world of possibilities in areas of global collaboration, disease management, research and seeking expert opinion.

The landmark compendium is poised to become a useful tool in the clinic for teachers, students, researchers, and parents teaming together to save 'Vision' of our newborns, especially but not limited to those 'born too early'.

My Best wishes

Dr. Subhadra Jalali

Network Director, Newborn Eye Health Alliance and Quality,
L V Prasad Eye Institute,
Hyderabad, India

Dr. GVS Murthy

Retinopathy of prematurity has emerged as an important public health concern in many low and middle income countries across the world. It is only recently that it is assuming epidemic proportions in countries like India with enhanced survival of pre-term new born babies due to improved neonatal care facilities being established. Initially it was thought to be localized to the metros in these countries but recent evidence shows that with increased urbanization rates, there is an increase in magnitude in the peri-urban and rural areas also.

Affordable and accessible imaging and grading technology has revolutionized the early detection of ROP and timely management preventing blindness. Different modalities have been tried recently to reach the vulnerable segments with great success. Task sharing with nursing personnel has increased the reach of programmes so that ophthalmologists need not travel to smaller townships for screening every newborn. Their valuable time has been optimized by providing them time to treat babies efficiently.

A health concern like ROP needs multi-disciplinary teams comprised of neonatologists, nurses and ophthalmologists supported by public health practitioners and technologists to improve efficiency and effectiveness of the different approaches. Public health practitioners prepare the template for planning and monitoring and are critical for the success of such efforts. Technologists work towards improving affordable diagnostic acumen while the clinical teams deliver programmes effectively using evidence-based algorithms. This book is a unique compendium that strings together valuable case-studies from different parts of the world and is therefore an excellent resource material for fighting avoidable blindness due to ROP.

Sincerely,

Dr. GVS Murthy, Director

Dr Anand Vinekar

Wide-field imaging has changed the way we care for retinopathy of prematurity the world over. Furthermore, portable and affordable devices have allowed middle-income countries like India to scale up their screening programs in the outreach through tele-ROP-based platforms.

This book is an excellent effort to consolidate the experiences of many such programs across the nation and the world using this technology. Undoubtedly, all such programs intend to prevent blindness in premature infants in their region, and this has been graphically captured in this book through its impact analysis.

This book is unique in its ability to unite technologists, ophthalmologists, pediatricians, health care providers and organisations. It serves as a user's manual as much as a testimony of the potential this technology promises. Here is hoping the book will encourage more ROP caregivers to adopt this technology to prevent blindness in our tiny and precious citizens.

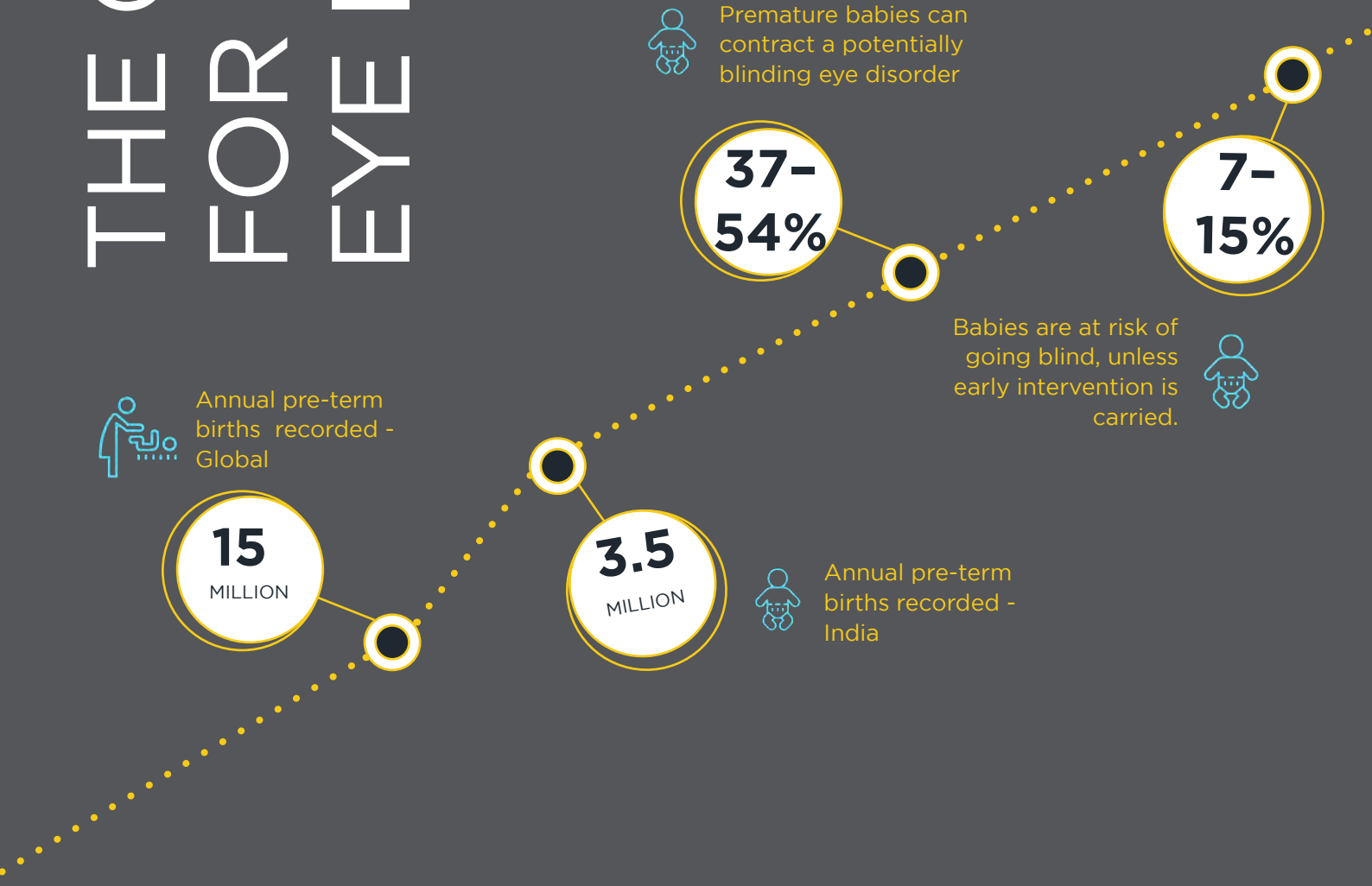
Sincerely,

Dr Anand Vinekar
Founder & Program Director, KIDROP
Head, Department of Pediatric Retina,

THE GLOBAL NEED FOR PEDIATRIC EYE IMAGING

Globally 15 million babies are born preterm each year, and is the leading cause of death in children under the age of 5 .Of these, 3.5 million preterm births are recorded in India alone. Many premature babies face a lifetime of disability, including learning disabilities, visual and hearing problems.

The need of the hour is an affordable, high quality wide-field imaging solution to screen, evaluate, and photo-document pediatric ocular diseases to prevent blindness in newborn babies.



ROP - THE PROBLEM

According to World Health Organization (WHO), there were 1.5 million children worldwide who were blind in 1999, only a small percentage of them were due to ROP. Over the last 10 years, this proportion of blindness as a result of ROP has varied and increased greatly among countries.

The need of the hour is an affordable, high quality wide-field imaging solution to screen, evaluate, and photo-document pediatric ocular diseases to prevent blindness in newborn babies.

THE NEED OF THE HOUR

A Portable, Affordable, high quality wide-field imaging solution to screen, evaluate, and photo-document pediatric ocular diseases to prevent permanent blindness in newborn babies.

Forus Health's flagship neonatal product 3nethra neo is a wide-field imaging system used for detection & photo documentation of ocular diseases that manifest in infant eyes.

Retinopathy of Prematurity (ROP)

Retinopathy of prematurity (ROP) is an eye disorder caused by abnormal blood vessel growth in the light sensitive part of the eyes (retina) of premature infants.

ROP is one of the few causes of childhood blindness. Its timely detection and treatment, can prevent permanent and irreversible blindness or severe visual impairment.

Blindness due to ROP can be prevented with 100% screening of all premature babies and intervention wherever required.

3nethra neo

DIGITAL WIDE FIELD IMAGING SYSTEM

Forus Health developed 3nethra neo wide-field imaging system used to screen, evaluate and photo document pediatric ocular diseases that manifest in the eyes of preterm babies.

The ergonomically designed, lightweight handpiece allows for single-handed operation, and captures 120-degree high-resolution images of posterior and anterior segments of the eye. 3nethra neo acquires only digital photographs of eye and does not provide any analysis or diagnosis. 3nethra neo is a contact device and can be easily operated by qualified technicians and is deployed in versatile clinical environments such as hospitals, operating rooms, and Neonatal Intensive Care Units (NICU).

SALIENT FEATURES

01 **Compact & Ergonomic** design

02 **Easy to use** pen-holder grasp for **single-handed operation**

03 **Easy to use**

04 **Intuitive controls** and workflow

05 **Track & Evaluate** disease progress

06 **Integrated provision** for historical data

3nethra

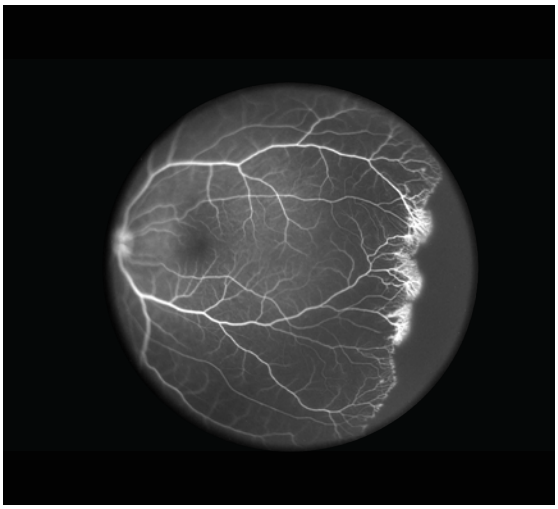
neo HD FA

DIGITAL ULTRA WIDE FIELD IMAGING SYSTEM WITH FA

Forus Health developed 3nethra neo HD FA ultra wide-field imaging system used to screen, evaluate and photo document pediatric ocular diseases that manifest in the eyes of preterm babies.

The ergonomically designed, lightweight handpiece allows for single-handed operation, and captures 150-degree high-resolution images of posterior and anterior segments of the eye. 3nethra neo HD takes fluorescein angiography (FA) images too. 3nethra neo HD is an image acqusition system only. 3nethra neo HD is a contact device and can be easily operated by qualified technicians and is deployed in versatile clinical environments such as hospitals, operating rooms, and Neonatal Intensive Care Units (NICU).

SALIENT FEATURES



01 **150 ° Field of view**

02 **20 MP Resolution**

03 **Fluorescein Angiography**

04 **Integrated Platform - FH Telecare**

05 **Portable & Affordable**

06 **Easy to use**

FH TELECARE

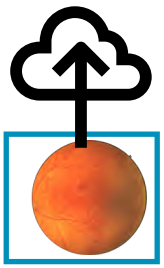
INTEGRATED PLATFORM FOR COMPREHENSIVE EYE CARE

Fully Managed

EYE CARE SOLUTION

By adopting best-in-class technologies and innovative deployment strategies, Forus Health's digital health platform FH TeleCare optimises remote retinal diagnosis of newborn infants for conditions like ROP, Retinoblastoma and congenital cataract.

Step 1:
Capture color retinal fundus images of babies



Step 2:
Upload images to cloud for review

Step 3:
Expert reviews patient data and generates report

Step 4:
Report is received at NICU

ROP screening workflow depiction.

Fully Managed Services

Fully-managed services shall be provided to clients on an at-risk model that involves minimum capital cost, where fees are structured as monthly subscriptions or per-patient examination fees.

Intelligent & Secure

FH TeleCare is an intelligent and secure cloud platform that connects multiple stakeholders in the eye care ecosystem and enables continuous ocular disease management.

Remote Diagnosis

The data generated by 3nethra neo device can be reviewed and monitored by eye care clinicians on web applications.

AI Integrated

A network of AI systems hosted on the cloud can improve clinical efficiencies and outcomes.

01
SCALABILITY

FH TeleCare solution is well architected to handle the increase in traffic. Microservices architecture helps to decouple dependency between software subsystems and avoids a single point of failure. Depending on the load, the application can automatically scale up without downtime and service disruptions—the provision provided to add additional VMs as per load with a load balancer.

02
AVAILABILITY

FH TeleCare solution is replicated across different geographical regions to ensure no downtime due to outages from Cloud Service providers in a particular geographical area. At present, FH Telecare solution is deployed across 3 data centres. (India, UK and USA)

03
SECURITY

FH TeleCare solution adopts stringent security measures per industry standards to ensure patient data privacy and data security. All data transfer happens over secure protocols like HTTPS with time-bound access tokens. Robust encryption mechanisms are in place to ensure patient data is not compromised. A comprehensive audit log is maintained concerning all data access across all functionalities.

04
3RD PARTY INTEGRATION

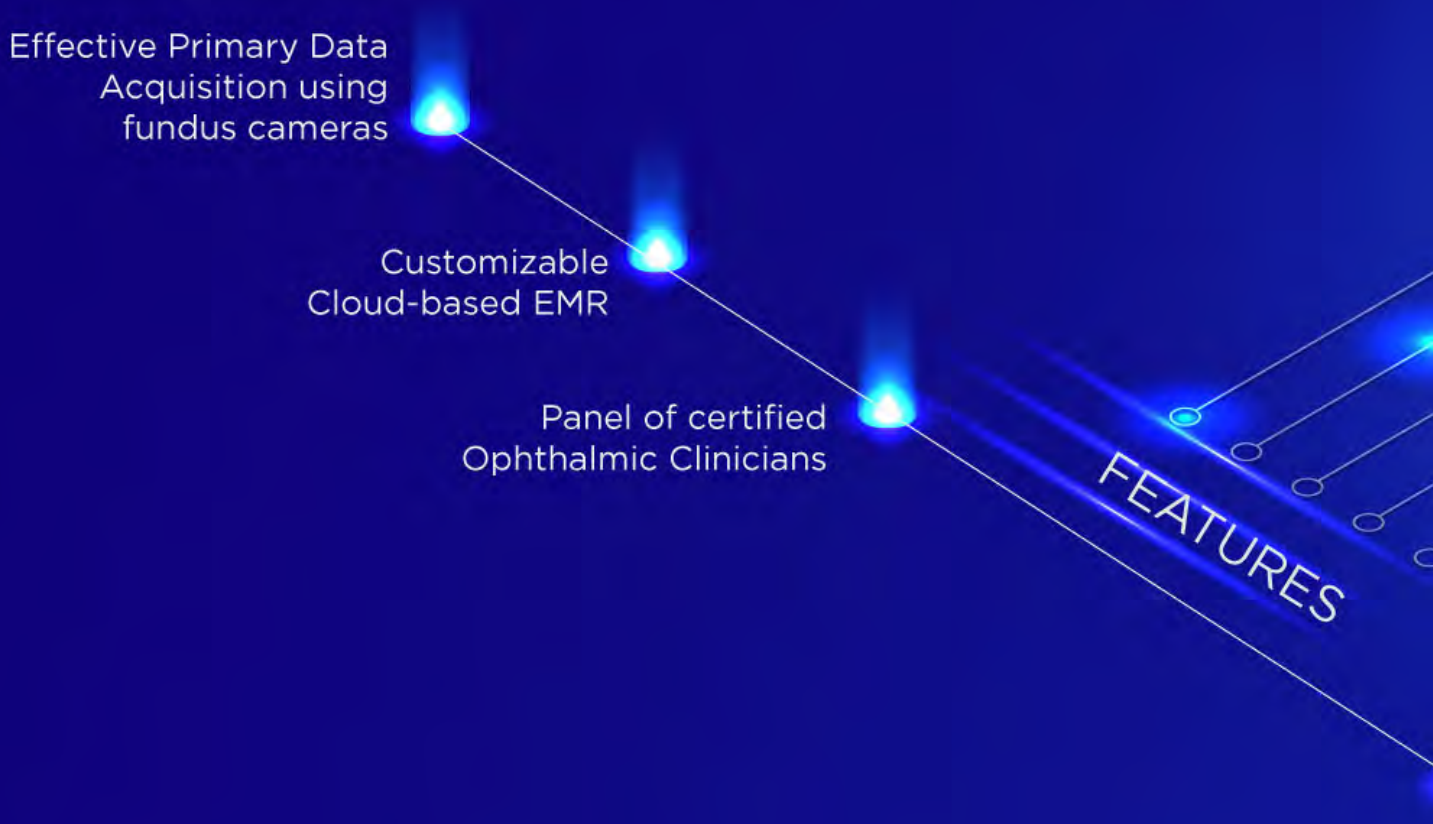
FH TeleCare solution can be integrated with any 3rd party solution using REST APIs for data exchange. We support two-way integration, i.e. data can be pulled from 3rd party applications, and data can be transferred to 3rd party solutions from FH Telecare. The platform supports integration with third-party DICOM compliant fundus cameras in addition to Forus Health's fundus cameras. FH TeleCare can interface with HL7 compliant cloud-based EMR systems

05
COMPLIANCE TO STANDARDS

FH TeleCare solution is compliant and certified to the following standards:
ISO 27001:2013
ISO 27017:2015
ISO 27018:2019
HIPAA,

FH TELECARE

FEATURES & ADVANTAGES



FAST SECURE SAFE


ADVANTAGES
Easy to implement and scale
Enhances patient care and comfort
Reduces review time and enables triage flow
Increases efficiency and reduces cost of care
PROTECT
Assisted AI to increase clinical efficiency
High data security & data privacy compliance (HIPAA compliant and ISO 27001. 2017/18 Certified)
SCALABLE AVAILABLE

AI FOR NEONATAL OCULAR CARE

FOR ASSISTED DISEASE DETECTION

OUR MISSION OF ERADICATING PREVENTABLE BLINDNESS

At Forus Health, we are committed to bringing state-of-the-art technology to fulfill our mission of eradicating preventable blindness. Deep Learning is one such technology that can be used for automated analysis of ophthalmic images and can potentially improve neonatal eye care, especially for ROP management. Improvements should be readily visible in the following areas:

ENABLING FASTER TRIAGING

It's a fact that there is an uneven distribution of pediatric retina specialists, primarily due to the urban/rural divide in developing nations. Even a typical telemedicine workflow has scope for improvement due to the high lead time for expert assessment. We plan to address this by enabling near real-time, automated risk assessment, which can be deployed in NICU setups.

OBJECTIVITY IN DIAGNOSIS

Inter-observer variability in assessment is well noted in retinal specialist community. We are working towards better generalizability in our AI system to reduce individual biases.

AI DEVELOPMENT METHODOLOGY

We aim to develop and deploy robust AI-based risk indication solutions for ROP with following primary objectives:

- Near real-time assessment "on edge" (without an Internet connection)
- Interpretability of results

To achieve this, we have compiled a database of neonatal retinal images over the years and collaborated with clinical experts globally to get them labeled. **We have about 150,000 images from thousands of infants,** spanning a wide distribution of risk factors such as gestational age and birth weight. Due processes are followed to ensure consent and anonymisation of the acquired data. Several challenges unique to this domain need to be addressed during the development phase of the AI solutions. To begin with, how do we decide on "ground-truth" labels for training AI models in the presence of a high degree of inter-observer variability? An ideal approach would be to have every case graded by multiple clinical experts and use a consensus-based scheme such as majority voting to arrive at the ground truth. However, such an approach is time intensive, especially given that there are insufficient ROP experts.

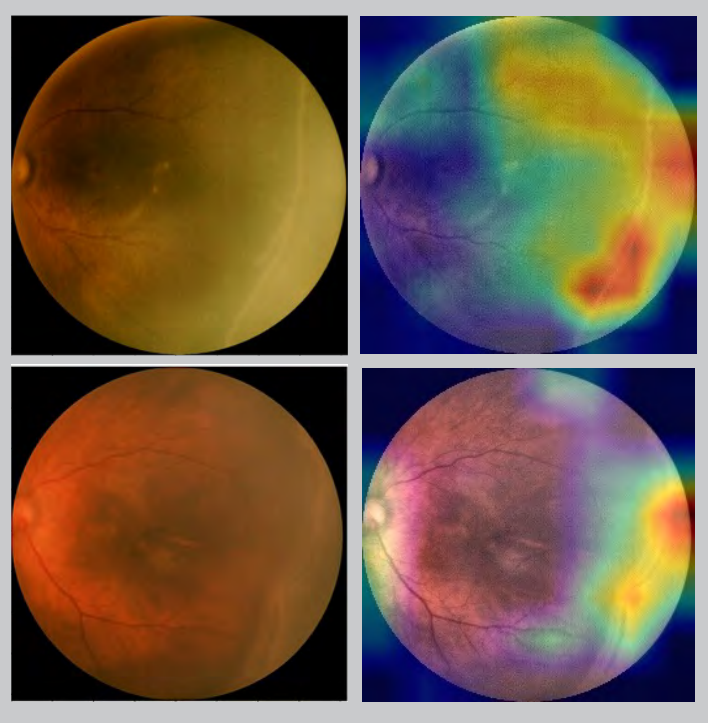
OUR APPROACH

We are constantly diversifying our database to reduce demographic bias.

Our approach is to distribute images among different experts. We then develop different AI models that learn from labeling performed by individual experts. AI models are then used to predict across each other's training image pools, and the discrepancies are used to evolve the next generation of AI models. Use of semi-supervised deep learning techniques is also being explored.

Another challenge is to have a fair representation of images for a global population of infants. Currently, our database have more images from South and South-East Asian countries, but we are constantly diversifying our database to reduce demographic bias. Our deployment plan also includes extensive validation across different geographies.

Optimal choice of deep learning model architecture is also essential. Since we intend to reduce inference time for near real-time assessment, it is crucial to find a balance between the assessment sensitivity, specificity, and run-time resource requirements. Thus, conventionally popular ensembling techniques are not necessarily ideal in this scenario since it involves running multiple AI models in parallel. This may lead to a resource crunch, especially on general-purpose PC / laptops, without dedicated graphics cards. Some alternative approaches that have given encouraging results include segmentation models, multi-class classification models, and "knowledge distillation" techniques.



We believe that our technical expertise and access to relevant data, positions us uniquely to translate recent advancements in the field of AI into meaningful solutions for neonatal ocular care and management. Some of our early results depict an intuitive, "heat-map" based region of interest indication:

15 million
Premature babies born across the world every year are at risk of becoming blind

THE IMPACT STORIES

NARAYANA NETHRALAYA

BENGALURU, INDIA

FIRST TELEMEDICINE PROGRAMME IN INDIA, REACHING UNDERSERVED AREAS FOR ROP SCREENING USING WIDE-FIELD IMAGING

Narayana Nethralaya (NN) is one of leading eye hospitals in India, which started retinopathy of prematurity (ROP) journey in 2007. NN initiated KIDROP, India's first tele-ROP program and is currently one of the largest single-centre ROP programs in the world. This programme is a mobile teleophthalmology-based unit designed to scale ROP screening in both rural and urban regions of Karnataka state. Trained operators travel to several districts of Karnataka with Forus Health's 3nethra neo a compact and portable wide-field imaging system to screen premature infants in NICUs that do not have access to ophthalmologists. Trained operators capture retinal images of the babies and share them with specialists on a cloud-based telemedicine platform for review. Ophthalmologists can now remotely diagnose eye condition and advice neonatologists on next steps. It's important to note that effective management of ROP requires routine screening before and after discharge.

In all, 135 NICUs across the state of Karnataka (Government and Private) are covered each week. Forty-four centres are in Govt district hospitals, and rest are in private centres.

"We consider ourselves privileged to be a part of Neo's journey since its inception. Its conceptualization, prototype design, clinical and field testing all happened not just in our hospital, but under rigorous conditions in our outreach centres as well, resulting in not only a technically sound camera, but one that would fill in the niche void that existed in our care of these tiny babies. By making it more portable, compact, lightweight, yet maintaining its wide-field optics, resolution and its integration into a telemedicine platform, we were able to scale up our program exponentially. The string of international accreditations and certifications that device went on to achieve bears testimony to its international class and excellence".

Dr Anand Vinekar

PROFESSOR & HEAD,
DEPARTMENT OF PEDIATRIC RETINA
PROGRAM DIRECTOR – KIDROP
NARAYANA NETHRALAYA, BANGALORE, INDIA

Over 2,20,000 screening sessions have been completed, and over 3000 babies have been treated thus far. This program is a public-private partnership with Government of Karnataka and has mentored other ROP programs across the country.

3nethra neo has helped expand tele-ROP (KIDROP) program wider than ever before. 3nethra neo's portability and compactness are essential factors in scaling this programme.

NN team is able to transport a single 3nethra neo across several neonatal units within each zone of KIDROP. 3nethra neo captures a retinal image with 120 degrees field of view, which helps their trained technicians capture retinal periphery, a pre-requisite for discharge from screening.

NN teams using 8 units of 3nethra neo cameras are able to complete over 2000 imaging sessions a month across 135 neonatal units in Karnataka, India.

IMPACT SCORE CARD

+135
Operating in Govt & Private NICUS

+71,000
Total Babies Screened

+3440
Total Babies treated

+391 M USD
Economic Impact of Blindness Burden saved

2007
WORKING ON ROP FROM

2016
USING 3nethra neo SINCE

NARAYANA NETHRALAYA

HOW WE SAVE

Love showered by families when we save vision of a newborn is priceless compared to wealth and privilege.

L V PRASAD EYE INSTITUTE

HYDERABAD, BHUBANESWAR, VIJAYAWADA, INDIA

PIONEER IN ROP SCREENING

LVPEI is a World Health Organization (WHO) Centre for the Prevention of Blindnesss

The L V Prasad Eye Institute (LVPEI) provides high quality comprehensive eye care to all people. LVPEI provides sight enhancement and rehabilitation services at the Institute and through its rural eye health network, offers professional ophthalmic training at all levels and conducts cutting-edge eye care research. The Institute is a World Health Organization (WHO) Centre for Prevention of Blindness and a Global Resource Centre for VISION 2020, a worldwide initiative for elimination of avoidable blindness led by WHO and the International Agency for Prevention of Blindness (IAPB).

ROP - A mission for LVPEI since 1999

ROP has become a mission for LVPEI since 1999 and a constant endeavour to translate information available in books and journals to actual implementation at the bedside of the new-born. There are a number of risk factors for new-born eye problems including premature birth, familial disorders, Rubella, Congenital diseases, poor cry at birth, etc that need to be addressed through a health sector-wide multidisciplinary approach and LVPEI has pioneered some such approaches. LVPEI team that is headed by Dr Subhadra Jalali includes Dr. Padmaja Rani and Dr. Divya Balakrishnan in Hyderabad, Dr. Tapas Padhi and Dr. Umesh Behera in Bhubaneswar, Dr. Sameera Nayak in Vijayawada and Dr. Virender Sachdeva in Visakhapatnam to further expand the new-born eye screening program to spread its reach to every baby in the hospital/NICU/SNCU across the country to enable them achieve their RIGHT to Sight!

LVPEI is working ROP screening projects for National Health Mission (NHM)

LVPEI has been running several ROP programs across the states of Telangana, Andhra Pradesh and Orissa. LVPEI has so far acquired eight 3nethra neo / 3nethra neo HD for ROP screening across these states. LVPEI is working on large volume ROP screening projects for National Health Mission (NHM) for several districts of the state of Odisha.

Dr Subhadra Jalali

NETWORK DIRECTOR | QUALITY |
NEW BORN EYE HEALTH ALLIANCE (NEHA)
LV PRASAD EYE INSTITUTE

"Clinical, educative, socioeconomic, and public health impact of 3nethra neo fundus imaging in my work has been substantive, when parents, extended family, trainees, and me, the clinician who must make critical treatment decisions, view the same clear image of retina of a baby together. We have deployed one device permanently in our OPD, a separate one to go around for outreach in scores of NICU and most important another one in OT for preoperative and post operative fundus photography of not only all pediatric retina surgeries but also by clinicians in pediatric oncology, childhood glaucoma and pediatric ophthalmology. Another area is collaboration in care. Whenever in doubt, it has been remarkable how the high resolution 3nethra neo fundus images that I send to my collaborators in other parts of the world convey the pathology readily , enabling them confidently provide their expert opinion. Same has been my ability to give opinion when these images arrive on my phone from a clinician providing care in a remote location".

ROP has become a mission for LVPEI since 1999 and a constant endeavour to translate information available in books and journals to actual implementation at the bedside of the new-born.

THE IMPACT

Currently using Eight 3nethra neos

1999

WORKING ON ROP FROM

2017

USING 3nethra neo SINCE

ARAVIND EYE HOSPITAL

MADURAI, INDIA

WORLD LEADER IN PROVIDING AFFORDABLE EYECARE

Aravind Eye Hospital Madurai started their outreach program for ROP screening of new born since 2017/18. Dr.Renu P Rajan heads ROP program of Madurai.

MASS SCREENING

Through this program, Aravind Eye Hospital has been very actively carrying out ROP screening on new born babies across Tamilnadu, India. They cover over 20+ organisations spanning Government and Private NICUs across Madurai and surrounding districts of Madurai. More than half of their ROP patients at base hospital Aravind Madurai have been identified through their outreach programs. Both 3nethra neo and RETCAM were used for screening.

Trained MLOP's conduct scheduled screenings at various Government hospital NICUs and private NICUs every day. Two 3nethra neo cameras are used for screening at multiple locations.

Off-late, staff at Government hospitals have developed skills in ROP screening. This has accelerated the screening process and increased operational efficiencies. Increased awareness in Government NICUs also helps in propagating ROP Screening and educating, patients at large

"3nethra neo has made a huge impact to our ROP program. An ideal portable companion for our outreach team in screening for ROP across 4 districts and more than 20 NICUs every week"

Dr. Renu P Rajan

Head of ROP Program
Aravind Eye Hospital
Madurai

THE IMPACT SCORE CARD

2015

WORKING ON ROP FROM

2018

USING 3nethra neo SINCE

+20
Reaching out to NICU's

+16,000
Babies Screened

+1600
Babies treated

+182 M USD
Economic Impact of Blindness Burden saved

ARAVIND EYE HOSPITAL

COIMBATORE, INDIA

WORLD LEADER IN PROVIDING AFFORDABLE EYECARE

Aravind Eye Hospital, Coimbatore is a satellite hospital of Aravind Eye Care System. In response to the increasing demand for eye care from patients in the north western part of Tamil Nadu, Aravind opened its hospital at Coimbatore in 1997. It is situated very close to the bordering states of Kerala and Karnataka. This hospital has facilities to accommodate 170 paying patients and 450 free patients. It is an accredited teaching institution. In the year ending March 2021, Aravind, Coimbatore handled around 328,161 outpatient visits and performed around 50,887 surgeries.

ROP screening started at Aravind Coimbatore in the year 2000. It then expanded to neighboring districts in Tamil Nadu and Kerala via telemedicine in 2000.

From March 2021, Coimbatore started using 3nethra neo camera. Total screened babies 4476, of which 2453 were males. 3499 babies were from government hospitals and 977 from private NICUs. Treatment was given to 113 babies of which 59 were given anti VEGF injections and 53 laser treatment. 1 required surgery.

"Our experience with 3nethra neo has been very good and we haven't missed any baby requiring treatment for ROP"

Dr. Parag Shah

MEDICAL CONSULTANT
RETINA & VITREOUS SERVICES
ARAVIND EYE HOSPITAL
COIMBATORE

THE IMPACT SCORE CARD

2000
WORKING ON ROP FROM

2021
USING 3nethra neo SINCE

+10
Reaching out to NICU's

+4476
Babies Screened

+113
Babies treated

+13 M USD
Economic Impact of Blindness Burden saved

ARAVIND EYE HOSPITAL

CHENNAI, INDIA

WORLD LEADER IN PROVIDING AFFORDABLE EYECARE

Aravind Eye Hospitals, Chennai started their flagship outreach program ACT – ROP (Aravind Chennai Tele – ROP) for ROP screening of new born from the year 2018 using Forus Health's 3nethra neo. Through this program, they have been actively carrying out ROP screening on new born babies for the past 4 years. They cover several Government NICU's and several Private NICU's spanning Chennai and surrounding districts of Chennai.

Operators were initially trained at Aravind Coimbatore. They now have in-house capacity of trained technicians (2 ROP Technicians and 1 MLOP) available for screening always. Their program has scheduled screening visits across several Government hospitals and Private NICU's on scheduled days every week thereby optimising operations. In government hospitals, they have a flow of 10-15 patients every visit that include basic screening, follow-up screening and Tele ophthalmology consultation for patients. Private hospitals refer critical ROP cases for screening and treatment that amounts to 4-5 every visit.

They procured 2 units of Forus Health 3nethra neo cameras for screening and have plans to expand to nearby towns in the near future. one 3nethra neo camera is used at Base hospital and one 3nethra neo camera is used for remote ROP screening.

"I am extremely glad that we have been able to expand our ROP services manifold since the time we started Aravind Chennai Tele ROP (ACT-ROP) screening program in 2018. Thanks to Forus 3nethra neo camera, a Made in India product designed exclusively for imaging retina in preterm babies, we are able to deliver high quality ROP services at an affordable cost. 3nethra neo is truly a game changer in this segment"

DR PRABU BASKARAN
MS, DNB
VITREO - RETINA SURGEON
ARAVIND EYE HOSPITAL, CHENNAI

THE IMPACT SCORE CARD

2018

WORKING ON ROP FROM

2018

USING 3nethra neo SINCE

+7
Reaching out to NICU's

+7000
Babies Screened

+600
Babies treated

+68 M USD
Economic Impact of Blindness Burden saved

COGNIZANT FOUNDATION

CHENNAI, INDIA

Problem Statement

According to a report by 'The International Agency for the Prevention of Blindness', 1.1 billion people live with vision loss globally, and 90% of vision loss is preventable or treatable. In 2020 in South Asia, there were an estimated 340 million people with vision loss; of this, 12 million people were blind. In 2020 in India, there were an estimated 270 million people with vision loss; of this, 9.2 million people were blind. Blindness and vision impairment are major public health problems in India that cause a profound human and socio-economic impact.

1.1 B

Live with vision loss globally

90%

vision loss is preventable

340 M

People with vision loss

2020 in South Asia,

270 M

People with vision loss

2020 in India

Cognizant Foundation has chosen "preventing avoidable blindness" as its flagship healthcare programme to make timely, quality eye care services accessible and affordable to underserved communities. The goal of this programme is to prevent disability in children and adults.

The Foundation aims to reduce the burden of blindness in India under the following programme themes:

- Preventing Childhood Blindness
- Increasing access to quality eye care for underserved communities

From 2018 to March 2022, this programme has reached out to 3.09 lakh lives in nine States - Andhra Pradesh, Assam, Karnataka, Maharashtra, NCR, Odisha, Tamil Nadu, Telangana, and West Bengal. The Foundation, along with its partner organisations, ensured that underserved patients received much-needed eye care amid the challenges and restrictions of the COVID-19 pandemic.

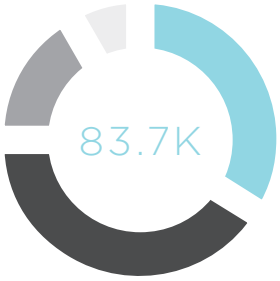
Preventing Childhood Blindness

Childhood blindness is recognised as an issue needing immediate intervention in India. There are several reasons for this urgency: First, children born blind or who become blind and survive have a lifetime of blindness ahead of them, with all the associated emotional, social, and economic costs to the child, the family, and society. To combat childhood blindness, the Foundation supports the following programmes.

i) School and community eye screening for Children

ii) Screening and treatment of ROP (Retinopathy of Prematurity)

Vision in School eye screening project for children in Nashik, Maharashtra children during 2018-2020.



Dr Shroff's Charity Eye Hospitals school eye screening project for children in North-West Delhi. Screened children during 2020-2022

School and community eye screening for Children

Uncorrected refractive errors are the single most significant cause of visual impairment. In children, this problem is further compounded as they may be unaware of it and may not even realise they are afflicted with defective vision. A significant percentage of visually impaired children in developing countries do not attend or drop out of school, increasing the likelihood of entering the poverty trap.

The Foundation's projects in this area provide comprehensive eye health services to children in the community and schools. Children are screened for refractive errors and other eye conditions while they are at school or right at their doorsteps. Those in need of spectacles are given prescription eyewear in the presence of their parents or teachers. Children needing surgeries and other treatment are referred to the base hospital, where the treatment is provided free of cost or at subsidised rates.

Cognizant Foundation had partnered with Mission for Vision in School eye screening project for children in Nashik, Maharashtra and has reached over 51,673 children during 2018-2020.

Cognizant Foundation has partnered with Dr Shroff's Charity Eye Hospital to implement the school eye screening project for children in North-West Delhi.

Due to the COVID-19 pandemic situation, CF and Dr Shroff's team decided to convert the school eye screening project into an innovative Community Eye screening project to address eye health among children. Braving the pandemic, the project team went door-to-door and screened children aged 0-18 years while taking necessary precautions against COVID-19. Over 83,790 children were screened under the project during 2020-2022; 2290 received spectacles, and 149 children received surgeries that helped prevent blindness. This project also raised awareness in the community about child eye health and precautions to prevent the spread of COVID-19.

Funded 4 ROP Projects

Cognizant Foundation has funded 4 ROP projects so far since 2019

Reached 7200 babies

programme reached over 7200 babies from disadvantaged backgrounds who were screened for ROP

Screening for and Treatment of ROP

Retinopathy of Prematurity (ROP) is an eye disorder that primarily affects premature infants. ROP usually occurs within two to four weeks after birth, and the main challenge is early detection and prompt and adequate treatment whenever required. Left untreated, ROP can lead to irreversible blindness or lifelong vision impairment. The incidence of ROP is rising rapidly and has penetrated the interior territories of many countries, and India is no exception.

The key challenges in treating ROP include awareness levels among parents, availability of skilled ophthalmologists to detect and treat the condition, and availability of medical equipment needed for diagnosis and treatment. To add to these, ROP does not produce any symptoms that make a swift diagnosis possible.

Cognizant Foundation has funded over 4 ROP projects so far since 2019 till date and has partnered with NGOs and specialist eye hospitals to launch projects for screening and treatment of ROP. The initiative has been implemented in Andhra Pradesh, Maharashtra, Odisha, Telangana, and Tamil Nadu, in partnership with L V Prasad Eye Institute (LVPEI), Hyderabad, H V Desai Eye Hospital, Pune, Mission for Vision, Mumbai, and Aravind Eye Hospital, Chennai.

From April 2018 to March 2022, the programme reached over 7200 babies from disadvantaged backgrounds who were screened for ROP. Over 1256 of these babies who needed treatment for ROP were provided for it free of cost, saving them from a lifetime of blindness.

IMPACT SCORE CARD

+4
Operating with partners

+7239
Babies Screened

+1256
Babies treated

+143M USD
Economic Impact of Blindness Burden saved

Increasing access to quality eye care for under served communities

Under its 'preventing avoidable blindness' initiative, the Foundation has made significant inroads into making quality eye health services accessible to under served sections of society. In this area, the Foundation supports projects under the following programme themes:
i) Setting up and running Vision Centers
ii) Providing state-of-the-art ophthalmic equipment to hospitals catering to the under served
iii) Support for ophthalmic research by premier eye health institutions

Setting up and running Vision Centres.

Cataracts and uncorrected refractive error are the two major causes of blindness in India. Lack of access is a barrier for the poor rural communities to avail eye care services. Distance and expenses such as transport fares and loss of daily wages are the key factors preventing people from accessing hospital services. In such situations, village Vision Centers have proved successful in making available quality eye services to remote communities.

The Foundation has set up several Vision Centers across Assam, Karnataka, Maharashtra and West Bengal in partnership with Globe Eye Foundation, Karnataka, Greater Lions Seva Nidhi, West Bengal, Lions Club of Jamalpur Welfare Trust, West Bengal, Mission for Vision, Mumbai, Operation Eye Sight India, Sundarbans Social Development Centre, West Bengal, and Sri Sankaradeva Netralaya, Guwahati. Each of these Vision Centers provides a permanent eye care facility for the people catering to a population of over 50,000. The Vision Centers screen underserved patients in remote rural locations and provide those needing surgery, medicine, spectacles, etc., with the necessary intervention.

Support for Ophthalmic Research by Premier Eye Health Institutions

Recognising the need for quality research in eye care, the Foundation supported premier eye health institutions like Aravind Medical Research Foundation (AMRF), Madurai, Tamil Nadu, Hyderabad Eye Institute, Hyderabad and Vision Research Foundation, Chennai. CF had partnered with AMRF to support equipment grants for the research in the areas of Fungal Keratitis, which aims to help AMRF develop evidence-based methods for delivering personalised treatment for patients affected by the disease. CF supported a grant for equipment for a research program for vision restoration in patients with Retinitis Pigmentosa in partnership with L V Prasad Eye Institute.

CF had supported Vision Research Foundation, Chennai, with high-end medical equipment for their research activities, and in partnership with Sankara Nethralaya, Chennai also extended support for free retinal injections for disadvantaged patients. The injection is administered to patients suffering from retinal conditions like Diabetic Macular Edema, Age-related Macular Degeneration, and Diabetic Retinopathy to help prevent irreversible blindness.

Improving Scale

by leveraging cost-effective Technologies

Under its 'Preventing Childhood Blindness', Cognizant Foundation has adopted technology innovations to maximise impact and achieve scale. It has helped strengthen the delivery and impact of the programme.

The 3nethra Neo is a compact, portable, easy-to-use mydriatic wide-field imaging camera developed by Forus Health, an Indian medical technology company working on technology innovation and creative business models to develop sustainable access to vision care. The 3nethra neo is an indigenous lower-priced alternative to the imported Retcam. The cost of the Retcam is 5 to 6 times the cost of the Neo camera. Neo Camera, at a lower cost with the same functionality, has facilitated ROP projects that were not possible earlier due to the prohibitive cost.

CEO - Message

"Technology can go a long way in maximising impact and achieving scale. Adopting technology innovations can help overcome prohibitive barriers. Companies and CSR Foundations can play a key role in working with implementing agencies to adopt technologies/create innovations to help solve some of the major challenges that our country has been grappling with. The Cognizant Foundation's screening for and treatment of Retinopathy of Prematurity (ROP) programme uses equipment like 3nethra Neo to screen preterm babies, and images are then sent over Whatsapp to ROP experts who see the images and provide their diagnosis. Usage of tele-consulting options helps address the shortage of ophthalmic experts and improves access to quality healthcare for the underprivileged".

Ms Rajashree Natarajan
Chief Executive Officer
Cognizant Foundation

The Cognizant Foundation's programmes for 'Screening and treatment of ROP' uses the 3nethra Neo equipment to screen preterm babies. The Neo camera also facilitates the capturing of the image of the eyes by a trained technician. The images are then sent over WhatsApp to ROP experts, who see the images and provide their diagnosis. Based on this consult, babies requiring intervention are provided with the necessary treatment. Usage of this tele-consulting option helps address the shortage of ophthalmic experts and improves access to quality healthcare for the underprivileged.

The Poona Blind Men's Association's
H.V. Desai Eye Hospital
EYE CARE INSTITUTE

H.V. DESAI EYE HOSPITAL

PUNE, INDIA

TELE-MEDICINE BASED ROP SCREENING REACHING REMOTE AREAS

More than 80% of the population that get benefit from this ROP screening programme are from socio-economically weaker sections.

Programme benefiting Socio-economical weaker community of Maharastra

PBMA-HVDEH covers 11 districts in Maharashtra covering a population of over 40 million.

H.V. Desai Eye Hospital (PBMA-HVDEH) one of the leading eye hospitals located in Pune, India, started a noble initiative of conducting ROP screening in remote areas of Maharashtra.
HV Desai Hospital's retina department team visits District Hospitals across Maharashtra every week for conducting ROP screening of new-borns.

Dr Suchita Kulkarni, Vitreo Retinal surgeon, is leading this telemedicine based ROP screening programme at H.V. Desai Eye Hospital.

PBMA-HVDEH uses Forus Health's 3nethra neo for performing ROP screening. Due to portability and compactness of 3nethra neo, PBMA-HVDEH is able to scale across 11 districts in Maharashtra covering a population of over 40 million. 3nethra neo's ease of use has played a key role in helping PBMA-HVDEH in training, empowering, key technicians perform independent ROP Screening.

2016 | STARTED USING
3nethra neo

Forus Health's 3nethra neo camera has revolutionised ROP care in terms of its affordability and portability. This makes it easy for the team to maintain high ROP screening coverage.

"3nethra neo camera has revolutionised ROP care in terms of its low cost and portability. This makes it easy for my team to maintain high ROP screening coverage. Let me emphasise here that low cost DOES NOT mean compromised quality. I am very happy with the quality of images captured using 3nethra neo and know that even mild changes in zone 3 will not be missed. Lastly, the role of neo as a teaching tool is unmatched. 3nethra neo helps me maintain an image bank , a vital tool essential while teaching young doctors and paramedical staff".

DR SUCHITA KULKARNI

VITREO RETINAL SURGEON
HV DESAI EYE HOSPITAL, PUNE

The Poona Blind Men's Association's
H.V. Desai Eye Hospital
EYE CARE INSTITUTE

IMPACT SCORE CARD

2006 WORKING ON ROP FROM

2016 USING 3nethra neo SINCE

+20 REACHING OUT NICU'S

+21,435 BABIES SCREENED

+1589 BABIES TREATED

+181M USD ECONOMIC IMPACT OF BLINDNESS BURDEN SAVED

The Institute of Tropical Ophthalmology of Africa, Mali

SANKARA NETHRALAYA

CHENNAI, INDIA

OPTHALMOLOGIST LED ROP SCREENING

Sankara Nethralaya (SN) Chennai follows a unique model consulting a few NICU's around Chennai who are NABH accredited. SN signs a MOU with their partner organisations. Currently, 3nethra neo is being used in OPD (Out patients Department) within SN and cover 6-7 NICU's within Chennai, both Government and private.

SN's screening process is initiated by a call to their coordinator by their partner organisation. Key criteria followed is when a baby does not get not discharged within 4-5 weeks due to systemic problem or discharged with Retina examinations appointment either at SN or Pediatric OPD.

Partner organisations organise OPD for discharged babies mutually pre-scheduled on defined days every week. This way SN specialists can screen 15-20 babies per visit. All needed equipment like, Laser, 3nethra neo or other devices are carried to site. SN team is headed by a Pediatric Retina ROP specialist doctor and technicians. Since Retina Doctors screen babies, immediate diagnosis and treatment is provided with their setup. This ensures more confidence to patients. Babies are followed up by same specialists to provide continuity of care in future.

3nethra neo is used as the need is seen and is used specifically for documenting babies that need follow-up for treatment. SN plans to start their outreach covering districts around Chennai in the near future and plan to use 3nethra neo and telemedicine platform for the same.

" 3nethra neo is portable, affordable and easy to learn. 3nethra neo provides wide field fundus images of reasonably good quality to identify treatable ROP "

Dr PRAMOD BHENDE

SENIOR CONSULTANT & DIRECTOR
VITREO RETINA DEPARTMENT
SANKARA NETHRALAYA

IMPACT SCORE CARD

+6
Reaching out to NICU's

+100
Babies Screened

+10
Babies treated

+1M USD
Economic Impact of Blindness Burden saved

2014
WORKING ON ROP FROM

2018
USING 3nethra neo SINCE

SWARAASHI NETRALAYA

MUMBAI, INDIA

USING WIDE FIELD IMAGING SYSTEM FOR EARLY ROP DETECTION

Swaraashi Netralaya is one of the best eye hospitals located in Mumbai, which was established by Dr Rakesh Shah, Medical Director at Swaraashi Netralaya. Primary motivation for Dr Rakesh shah for conducting ROP screening is to detect and prevent blindness in newborns from ROP. Timely and regular screening is essential for early detection & prevention of ROP. Dr Rakesh Shah carried out ROP screening using indirect ophthalmoscope in his early days during 2010-11, He covered multiple NICUs across Thane, Mumbai and Navi Mumbai.

Dr Rakesh Shah tried using different non-contact devices for ROP screening but nothing was up to the mark and not repeatable. Also, it was difficult to achieve any standardisation and wide field.

2010

WORKING ON ROP FROM

2018

USING 3nethra neo SINCE

Forus Health's 3nethra neo wide-field imaging system for ROP screening is quite helpful and critical. It solved our issue of objective evidence based screening while providing great retinal photography of infants for ROP treatment.

3nethra neo also serves as a tool for medico-legal purposes and enhances consultation, improving communication with infants' parents about treatment and follow-up.

Dr Rakesh Shah has screened more than 10,000 babies for ROP. He has treated over 3000 babies with laser, anti vegf and surgeries. He believes that early detection of ROP is the key to successful treatment and saving vision.

Dr Rakesh Shah

OPHTHALMOLOGIST AND EYE SURGEON
SWARAASHI NETRALAYA, MUMBAI

"Forus Health's 3nethra neo wide-field imaging system for ROP screening provides great retinal photography in infants for ROP and treatment. 3nethra neo images enhances consultation, improving communication with infants' parents about the treatment and follow-up. It also serves as a tool for medico-legal purposes "

OPERATING IN REMOTE SNCU ACROSS THANE, MUMBAI AND NAVI MUMBAI

+3,000
BABIES SCREENED

+500
BABIES TREATED

+57M USD
ECONOMIC IMPACT OF BLINDNESS BURDEN SAVED

DHAMI EYE CARE HOSPITAL

LUDHIANA, INDIA

ENHANCING PARENT SATISFACTION FOR ROP TREATMENT USING WIDE-FIELD RETINAL IMAGING

Programme benefiting socio-economically weaker community. Ludhiana, Punjab

2018 | STARTED USING

3nethra neo

Dr Abhinav Dhami from Dhami Eye Care clinic (DEC), Ludhiana started his ROP practice in 2015 while completing his fellowship at Sankara Nethralaya. During his initial days of ROP practice, challenge was always to understand how disease grows and bigger challenge was to create awareness about this condition. Initially his idea was to do something different in his city by introducing an imaging system helping parents see and understand what is happening with their baby's eye. This would make it easier to convince and receive consent.

Dr Abhinav got an opportunity to witness the performance of Forus Health's 3nethra neo in comparison to competition in Banglaore. He felt 3nethra neo's imaging was equally reliable, easy to maintain and easy to use by a technician as well. In 2018, DEC bought Forus Health's 3nethra neo. They have screened 600 to 700 babies till date and have treated around 15-20 babies with antigen.

Played a crucial role in substantially increased follow-ups

2015

WORKING ON ROP FROM

2018

USING 3nethra neo SINCE

“ I am really thankful to Forus Health team for developing such a good device. 3nethra neo enables doctors and parents work together ”

DR. ABHINAV DHAMI

OPHTHALMOLOGIST
DHAMI EYE CARE HOSPITAL, LUDHIANA

Digital imaging system like 3nethra neo enables evidence and objectivity based management and treatment. Doctors ability to counsel parents on the progression or regression of this disease became much easier.

3nethra neo also played a crucial role in substantially increasing follow-ups, and parents were convinced to get treatment for their child. Overall, Forus Health’ 3nethra neo has helped manage our ROP practice.

OPERATING IN OWN HOSPITAL’S NICUS

+180

BABIES SCREENED

+30

BABIES TREATED

+3M USD

ECONOMIC IMPACT OF BLINDNESS BURDEN SAVED

IMPACT SCORE CARD

BANKERS RETINA CLINIC & LASER CENTRE

AHMEDABAD, INDIA

LEADERS IN ROP SCREENING & TREATMENT IN THE STATE OF GUJARAT

Dr Alay Banker is the director of Bankers Retina Clinic, Ahmedabad, and one of few ROP specialists conducting ROP screening in Gujarat.

19,990 babies have been screened using 3nethra neo.

Bankers Retina Clinic & Laser Centre was using Retcam earlier for their ROP screening and found it very expensive and difficult to carry around. While they continue using it in their base hospital, Dr Alay Banker was looking for an affordable retinal camera that had the same quality as Retcam. They found 3nethra neo to be compact and easy to use. Being a charitable hospital, cost was a major concern as much as running a tight screening schedule.

Bankers Clinic has been using Forus Health's 3nethra neo camera for ROP screening programs in Gujarat for the past 3 years. They have screened 19,990 babies using 3nethra Neo. Their present ROP screening programme covers NICUs in 23 hospital across 4 districts and has saved around 1200 babies from blindness. Bankers Clinic looks forward to more motivated and passionate people for expanding ROP screening across Gujarat.

Expecting more motivated and passionate people to expand ROP screening across Gujarat.

According to Dr.Alay, one of the biggest advantage of 3nethra neo is that it is extremely lightweight making it easier to carry between multiple NICUs for screening thereby helping scale ROP screening to a larger section. FH Telecare telemedicine software provided by Forus Health equips hospital in carrying out remote screening with the help of trained technicians. Its ease of use and excellent captured images even in extreme periphery regions is one of main reason that helped hospital scale successfully.

DR ALAY BANKER

BANKERS RETINA CLINIC & LASER CENTRE
AHEMEDABAD

" It is easy to use and allows my technicians capture excellent images even in extreme periphery regions I find the 3nethra neo camera quite user-friendly and particularly, being lightweight makes it easier to carry between multiple NICUs. I am very impressed with their FH Telecare telemedicine software where we upload images for remote screening. I feel the 3nethra neo's image quality is comparable to Retcam camera and would strongly recommend using this relatively affordable 'Made in India' camera for ROP screening. We also saw that Forus Health's team was quite supportive and resolved any device related issues immediately during installation."

2008

WORKING ON ROP FROM

2017

USING 3nethra neo SINCE

+23

OPERATING IN PRIVATE & GOVT NICUS ACROSS DISTRICTS

+19,900

BABIES SCREENED

+3400

BABIES TREATED

+387 USD

ECONOMIC IMPACT OF BLINDNESS BURDEN SAVED

IMPACT SCORE CARD

Englewood Health, New Jersey, USA

HAVE A HEART FOUNDATION

BENGALURU, INDIA

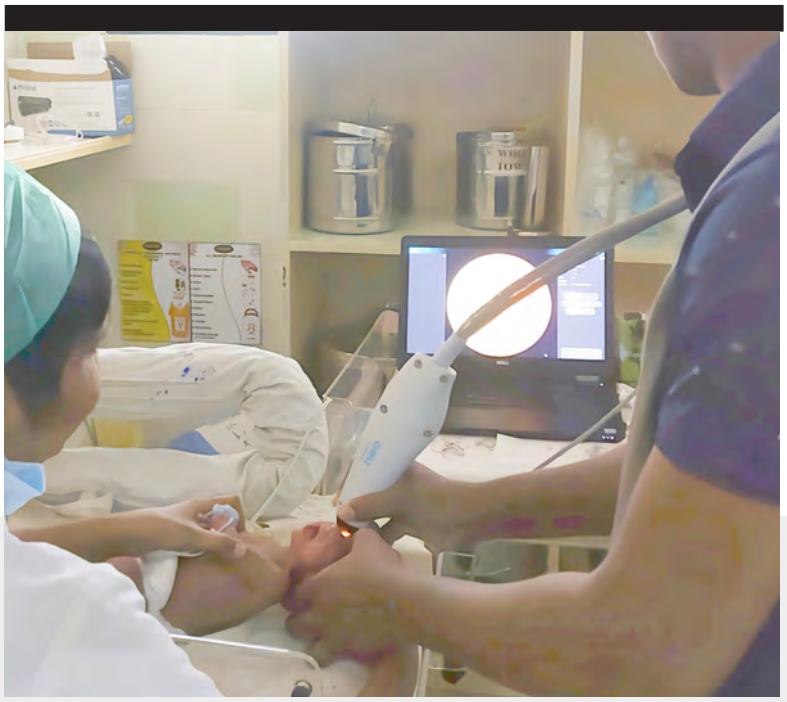
Have a Heart Foundation

SUPPORTS SEVERAL ORGANISATIONS FOR SCREENING AND TREATMENT OF ROP ACROSS INDIA

"My congratulations to Forus Health Pvt. Ltd for inventing and manufacturing 3nethra neo device for infant retinal imaging that is affordable and user friendly when compared to previously available technology. Numerous Ophthalmologists using 3nethra neo are delighted as the camera helps in accurate diagnosis and comparison with previous screened images. Saved Images are a very useful teaching tool for students and helps in counseling parents about the disease and the need for treatment. History data helps in medico legal situations as well.

We wish them all the very best and hope to buy many more 3nethra neo cameras and help in ROP detection across India. Since 3nethra neo can be used by a technician apart from an ophthalmologist / retina specialist to screen patients at remote locations, dozens of babies were saved from going blind simply because these technicians could take images from a remote location and send it to Retina specialist to help identify problems earlier".

Mr. Manohar Chatlani,
MANAGING TRUSTEE,
HAVE A HEART FOUNDATION



Statistics

Have A Heart Foundation has provided 3nethra neo and laser equipment for screening along with two trained Technicians for outreach screening activities to Sewa Sadan Eye Hospital, Bhopal. Until June 2022, 476 babies were screened and 26 babies treated with laser procedure to save them from going permanently blind. (These numbers are approximately equal to the world wide average of one in 18)

Two 3nethra neos were provided in Jaipur for screening– one to cover all Government hospitals and one to private and peripheral hospitals. We started an outreach program starting June 2022 with a dedicated technician for screening at different outreach locations. From January 2022 till date, we have supported treatment of 27 babies and prevented them from going blind.

Dr. Tufela Shafi, Ophthalmologist at GB Pant Government Hospital, Srinagar screens babies in their NICU and also does laser for babies found with ROP. Her biggest challenge was to maintain records of these babies who require follow up since all these activities were carried out with an indirect ophthalmoscope. 3nethra neo helped ease this process significantly. Dr. Tufela Shafi underwent training for a week at Narayana Nethralaya under the guidance of Dr.Anand Vinekar in Bangalore. At present, 3nethra neo is being effectively used and screening carried out for 206 babies over multiple screening sessions during the last 6 months.

GB Pant Children Hospital, Srinagar

FORUS 3nethra neo – BEYOND ROP

"I imaged a child who had bilateral retinoblastoma, a life threatening eye cancer recently using 3nethra neo. I could assess result of treatment, through multiple history image capture and was pleasantly surprised to see a positive response. This child's family is from an economically weaker community who could not return back repeatedly for treatment and asked us to do whatever we could.
We laser treated this child recently again to remove any trace residual disease in him. We sincerely hope to continue our treatment with follow-up imaging in the next 2 weeks."

Dr. Tufela Shafi (MS)

GB PANT PEDIATRIC DEPARTMENT OF OPHTHALMOLOGY, SRINAGAR

INDIRA GANDHI MEDICAL COLLEGE & HOSPITAL

SHIMLA, INDIA

MAKING ROP SCREENING ACCESSIBLE ON THE HILLS

Indira Gandhi Medical College & Hospital (IGMC) is the oldest medical institute and hospital in Shimla. IGMC has a full-fledged NICU, Gynaecology department and hence receives high rate of premature babies. IGMC used to earlier send referred ROP infants to PGI Chandigarh for treatment.
Shimla with its challenges of terrain, weather etc made it cumbersome for patients and babies lost critical time in the process. Dr Praveen was initially working as an anterior segment doctor in IGMC Shimla. He realised that Retinopathy of premaurity (ROP) is a critical condition that can lead to blindness if not identified or treated on time.

IGMC started using Forus Health's 3nethra Neo from 2017. They find 3nethra neo to be of great help in training IGMC's post graduate students on how to screen and treat for ROP. Earlier Dr Praveen used to train their students with indirect ophthalmoscope. Students would find it difficult to comprehend.

With the help of 3nethra neo, students now see live screening and learn much faster. Secondly, 3nethra neo has also been quite useful in following up with their patients who have been diagnosed with a problem. Thirdly, it has also been quite helpful in enhancing communication with parents. Since ROP also involves litigation, if a baby is not screened on time and goes blind hospital becomes liable.. FH Telecare address this gap too with history data for every patient.

IMPACT SCORE CARD

+6
Reaching out to NICU's

+240
Babies Screened

+16
Babies treated

+2 M USD
Economic Impact of Blindness Burden saved

2014
WORKING ON ROP FROM

2018
USING 3nethra neo SINCE

" 3nethra neo has been a great and helpful device. It is a critical need for hospitals to examine babies since all district level hospitals have NICUs and hence extremely essential to screen babies on time for ROP . This can enable early detection of ROP and prevent blindness in infants "

Dr Praveen Kumar

ASSOCIATE PROFESSOR
INDIRA GANDHI MEDICAL COLLEGE & HOSPITAL (IGMC)
SHIMLA

NUTEMA EYE CARE

MEERUT, INDIA

PRIVATE HOSPITAL OFFERING HIGH QUALITY ROP SCREENING FOR NEWBORN

Dr Priyank Garg from Nutema Hospital in Meerut was initially working as an anterior segment doctor primarily focused on treating cataract for many years. He subsequently enrolled for a fellowship in retina and continued working on retinal problems. He had initially not focussed on retinopathy of prematurity (ROP) and even during his fellowship, he saw few ROP cases.

Dr. Priyank Garg started Project Nutema with 50 bed NICU capacity hospital in 2017 where screening for babies for eye problems had to be initiated.
He did not have skilled technicians to conduct ROP screening at that moment and hence started with handling screening and treatment himself. During this process, he was introduced to Forus Health's 3nethra neo by his doctor friend.

Dr Priyank decided to buy 3nethra neo to not only screen babies for ROP but also as a comprehensive system to document condition for medico legal purposes. Other cameras used for the same purpose were very expensive and immobile. They subsequently underwent training under
Dr Anand Vinekar at Narayana Nethralaya. Here they learned more about ROP management techniques. This initiative has been successfully running for the past 6 years.

2017 WORKING ON ROP FROM

2017 USING 3nethra neo SINCE

"3nethra neo has been great as a tool not just for ROP screening but also to document the condition for medico legal purpose"

DR PRIYANK GARG

OPHTHALMOLOGIST
NUTEMA EYE CARE, MEERUT

OPERATING IN OWN HOSPITAL'S NICUS

+494
BABIES SCREENED

+84
BABIES TREATED

+10 M USD
ECONOMIC IMPACT OF BLINDNESS BURDEN SAVED

IMPACT SCORE CARD

3nethra neo helps in not only screening babies for ROP but also as a documenting tool for medico legal purposes.

3nethra neo was a need

Other cameras used for the same purpose were very expensive and immobile.

RADHATRI NETHRALAYA

AN NABH ACCREDITED ORGANISATION

CHENNAI, INDIA

BUILDING AN ROP INSTITUTION FROM GROUND-UP

Dr. Vasumathi first started as a fellow in the ROP team at LV Prasad Eye Institute, Hyderabad. She was supervised by Dr. Shubadra Jalali, one of India's leading pediatric retinal ophthalmologist. She was a subsequently a consultant at Aravind eye care, Madurai for 5 years. During initial days of her career, Dr. Vasumathi would visit hospitals, dilate, screen, treat all babies by herself at government and private hospitals in Chennai. They would carry a laser machine and a LIO, went around screening and treating patients.

Dr Vasumathi and her husband started Radhatri Nethralaya 13 years back and provided ROP care for under-privileged babies under their "bala nethra" program where they have screened 1000+ babies. Their long term ambition was providing tele-ophthalmology solutions in rural/semi rural areas. During 2015 Chennai floods they lost their entire hospital equipment and had to restart again. Motivation to move forward came in the form of a grandmother from a village who brought a baby 4 days after floods to their clinic. They did not have a single machine to conduct necessary examinations, The grandmother said she will come back after a week. By the grace of God and patients belief in Radhatri, they got back on their feet with renewed vigour.

They understood that it is difficult for patients to come from long distances especially travelling by multiple public transports with fragile babies. So in June 2018, they formed a public charitable trust with funds from school friends, Industrial houses, philanthropists etc . With this they bought their first Forus Health's 3nethra neo.

Radhatri named their program "Vision on wheels". Doctors were so thrilled to send vehicle to outreach program for the first time. Padiatricians, NICUs, came in touch with them and with public private partnership they established their flagship program. "Vision on wheels" is a free service and covers 300 kms beyond Chennai in rural TN and Andhra Pradesh

3nethra Neo device is out every single day screening patients for the past 3-4 years starting 2018. Radhatri at present addresses 2 locations simultaneously every day with two 3nethra neo's. Complete screening, documentation and follow-up is managed by 3nethra neo and FH Telecare cloud software. In this long journey, 3nethra neo has helped Dr. Vasumathi's long term dream come true of taking ROP care to doorsteps of villages so that no baby in Rural India becomes unnecessarily blind.

“3nethra neo has helped my long term dream come true of taking ROP care to doorsteps of villages so that no baby in Rural India becomes unnecessarily blind”

Dr Vasumathi Vedantham

CONSULTANT OPHTHALMOLOGIST & MEDICAL DIRECTOR, RADHATRI NETHRALAYA CHENNAI

THE IMPACT SCORE CARD

2008 WORKING ON ROP FROM

2017 USING 3nethra neo SINCE

+10 OPERATING IN PRIVATE & GOVT NICUS ACROSS 8 DISTRICTS

+ 26,225 BABIES SCREENED

+ 2100 BABIES TREATED

+239M USD ECONOMIC IMPACT OF BLINDNESS BURDEN SAVED

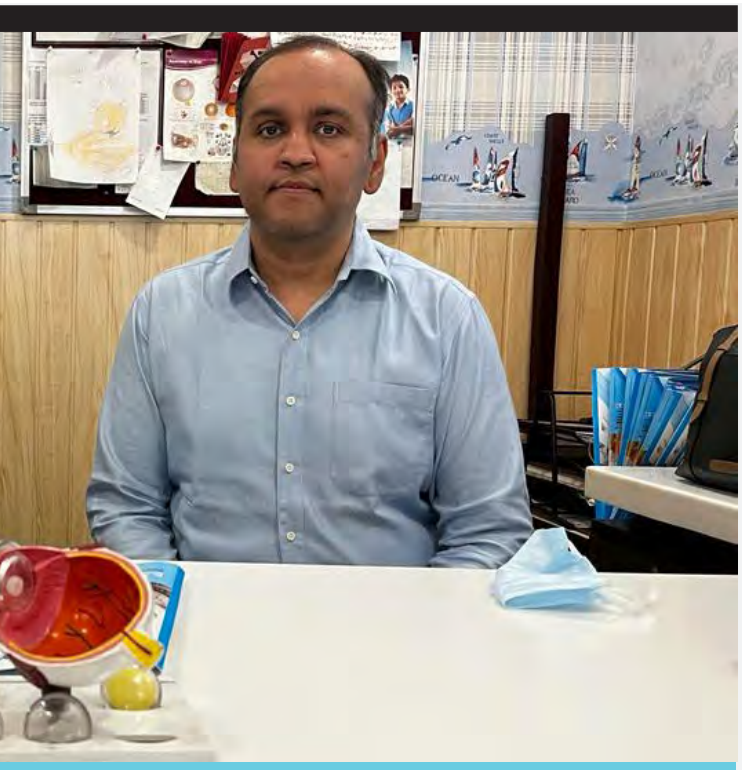
DR. SUBODH AGARWAL MEMORIAL HOSPITAL

LUCKNOW, INDIA

NICU OUTREACH PROGRAMME ENABLED BY WIDE FIELD IMAGING

Dr Samarth Agarwal is a retina specialist practicing in Lucknow, capital of the most populous state, Uttar Pradesh in India. His journey in ROP started along with his wife Dr. Arti Elhence, who is also a Pediatric ophthalmologist. They started the state's first tele-Ophthalmology ROP screening program using RETCAM camera in 2014 covering more than 20 NICUs in the state. Over the last 8 years their team have managed around 15,000 ROP screenings. Doctors and technicians were trained by the KIDROP program and mentored by Dr. Anand Vinekar. The association with Forus Health has been long and fruitful says Dr. Samarth.

Dr. Samarth is one of the first users of Forus Health's 3nethra neo wide - field imaging camera in the state and have been using it for NICU out reach program from the time it was commercially available. They have also validated 3nethra neo's image quality and utility with competitors camera and found it to be of good quality at a relatively affordable cost.



“ Forus Health’s 3nethra neo wide - field imaging camera is being used for our NICU outreach program from the time it was commercially available. We find 3nethra neo’s image to be of good quality at a relatively affordable cost”

Dr Samarth Agarwal

RETINA SPECIALIST
DR SUBODH AGARWAL MEMORIAL (SAM) EYE HOSPITAL HAZRATGANJ, LUCKNOW

2014

WORKING ON ROP FROM

2017

USING 3nethra neo SINCE

+20
OPERATING IN NICUS OF LUCKNOW

+15000
BABIES SCREENED

+3000
BABIES TREATED

+341 M USD
ECONOMIC IMPACT OF BLINDNESS BURDEN SAVED

RAJAN EYE CARE HOSPITAL

CHENNAI,INDIA

BUILDING A UNIQUE ROP SCREENING MODEL (ROTROP) WITH SUPPORT OF ROTARY INTERNATIONAL

Key highlight of ROTROP program is that RECH is able to screen babies who are extremely small in size and weight, who cannot be transported to other referral centres and treat them on time.

Rajan Eye Care Hospital (RECH), Chennai, ione of the leading super speciality eye hospitals, in collaboration with Rotary Club of (T Nagar branch) launched an ROP screening initiative called **"ROTROP"** in 2019. This program identifies NICUs in the city that do not have an active ROP management team and provides mobile access to ROP care. A team of photographers/operators visit these NICUs once a week and conduct screening using 3nethra neo on new born infants who were undergoing intensive care. These images are shared with Rajan Eye Care doctors who do remote diagnosis. Photo documentation is an effective tool for counselling parents and also to monitor progress of treatment or intervention.

Earlier, doctors would physically travel to these multiple hospitals and conduct screening using an indirect ophthalmoscope and record a subjective diagnosis. Neonatologists or parents never had a visual understanding of the diagnosis. This made it very difficult to fully understand its significance.

However, with introduction of 3nethra neo in their ROP practice, neonatologists and parents have a clear understanding of an infant's eye health based on evidence and this makes it easier for RECH to prescribe urgent treatment if necessary.

Key highlight of this program is that RECH is able to screen babies who are extremely small in size and weight, and with late stage ROP who cannot be transported to other referral centres. Once diagnosis gets confirmed, timely treatment is provided on site in the NICU resulting in early detection and reversal of ROP.

THE IMPACT SCORE CARD

+7
OPERATING IN GOVT & PRIVATE NICUS

+4620
BABIES SCREENED

+80
BABIES TREATED

+9M USD
ECONOMIC IMPACT OF BLINDNESS BURDEN SAVED

" 3nethra neo has revolutionised the way we manage ROP in our clinic. It has initiated the trend of tele-screening, enabling us reach out to more babies. It helps us counsel parents using visual display of images and explain objectively the nature of retinal disease thereby improving compliance. Documentation of fundus images leaves no scope for ambiguity and charts out efficient management plan. It is highly affordable and hence provides a huge techno commercial advantage."

Dr. SUPRIYA DABIR

RETINA SPECIALIST
DR RAJAN EYE CARE
CHENNAI

BANSARA EYE CARE CENTRE

SHILLONG, INDIA

Only hospital delivering
ROP care in the remote hills of Meghalaya

Bansara Eye Care Center through its charitable arm Society for Promotion of Eye Care and Sight has the only ROP management program in Shillong, Meghalaya in the North East of India. This program caters to a population of 3.6 M rural and tribal people. Headed by the Dr. Tania Basaiawmoit who is a trained VR surgeon, Bansara Eye Care Center is the only hospital in the region with a dedicated Vitreo-retinal department, arguably the only hope to develop an ROP management program and training center. Bansara Eye Care Centre has established themselves as a nodal referral hospital for the government of Meghalaya under the RBSK program that covers ROP management. They also successfully collaborate with multiple hospitals in the city providing ROP care. Equipped with 3nethra neo (a portable wide-field imaging system) and a team of trained photographers and medical technicians, the hospital over the last three years has screened more than 350 babies and treated around 60 babies, and helped prevent vision impairment.

ROP screening program developed by Bansara Eye care Center was originally inspired by the success of KIDROP in the state of Karnataka, and in view of the same they intend to develop a state-wide program called “MEGROP”. 3nethra neo has been instrumental in the success of their program, primarily due to the ruggedness and form factor that makes it easier to transport and maintain in difficult terrains.

THE IMPACT SCORE CARD

2019

WORKING ON ROP FROM

2019

USING 3nethra neo SINCE

+2

OPERATING IN GOVT & PRIVATE NICUS

“ Our journey in helping babies with ROP has only been possible because of the screening possibility that 3nethra neo gave us. Apart from being cost-effective, 3nethra neo is a compact, portable and easy-to-use mydriatic wide-field digital imaging system that has proved itself even in difficult terrain. Backed with great after-sales support and effective training for our optometrists, the possibility of screening babies across hospitals turned into a reality. A definite go-to for hospitals working in low resource settings wanting to make a difference”

Aaron Basaiawmoit,
CEO, Bansara Eye Care Centre

+400
BABIES SCREENED

+60
BABIES TREATED

+7 M USD
ECONOMIC IMPACT OF BLINDNESS BURDEN SAVED

PUSHPAGIRI VITREO RETINA INSTITUTE
An eye for affordable services

PUSHPAGIRI VITERO RETINA INSTITUTE

SECUNDERABAD, INDIA

PUBLIC PRIVATE PARTNERSHIPTO IMPLEMENT LARGE SCALE TECH-SUPORTED ROP SCREENING

Public, private partnership programme benefiting socio-economically weaker community.

Pushpagiri Vitreo Retina Institute is a not-for-profit NABH accredited super specialty eye care hospital committed to reducing avoidable blindness among preterm infants due to Retinopathy of Prematurity (ROP) in the states of Telangana and Andhra Pradesh. PVRI, through its 3 tertiary eye-care centres in Hyderabad, Vizianagaram and Kadapa have collaborated with various secondary and tertiary health facilities in public and private sectors for combating risk of blindness due to ROP since 2015. PVRI did this with the support from State governments as well as private hospitals who have worked with PVRI to provide ROP screening services to all their "at-risk" babies.

The initiative received a large boost in 2018 when Forus Health Pvt. Ltd through its tele-ophthalmology FH Telecare supported 3nethra neo HD have enabled PVRI expand their reach to screen babies in a greater number of districts. 3nethra neo technology has been revolutionary in cutting costs, personnel requirement and improved efficiency in timely screening, maintaining medical & imaging records, ease of use and more importantly help in capacity building of SNCUs/Neonatal teams. 3nethra neo's presence has enabled the PVRI mentoring team train nurses for acquiring retinal image from neonates and share fundus images for immediate review. This efficient model has been appreciated by state governments and has enabled PVRI effectively screen babies in 4 major high volume tertiary care SNCUs and also cover facilities in 13 districts across both Telangana and AP since late 2021.

2018 | STARTED USING 3nethra neo

HOW WE SAVED

All disadvantages faced during Covid-19 pandemic were also easily avoided due to presence of 3nethra neo's in health facilities.

PVRI's pediatric retinal screening team led by Dr Sai Kiranmayee has been effective in screening around 6277 babies since 2014 across various private and public health facilities. The screening rate since the introduction of the tech-supported 3nethra neo has gone up by almost 220%. PVRI used to screen close to 150-180 babies every month within centres. This number has gone up beyond 400 per month in 2022.

Close to 75% of babies reported to be screened in the centres are likely to be in the lower socio-economic groups. Most of the parents could not afford any treatment for ROP. Early diagnosis and timely treatment can avoid any negative impact on the baby's quality of life. The user-friendly nature of 3nethra neo and the ease of portability helped PVRI's health facilities to become self-sustainable in performing ROP screening independently.

"3nethra neo Fundus camera has reduced the burden of ROP screening on eye care personnel significantly and has helped the SNCUs pediatricians and nurses to becomes self-sustainable in identification of retinal anomalies. This will help integrate eye-care and neonatal care services ensuring proper screening and referral cycle maintenance.

3nethra neo quality of images captured using this camera are very helpful in identifying a defective retina from a normal one. It also serves as a tool of training for the faculty as well as a counselling tool for explaining eye condition to parents of babies. ROP is a completely avoidable condition and such innovations help us avoid it 100%"

Dr. P Sai Kiran Mayee

HEAD - PEDIATRICS VITREO RETINAL SURGEON
PUSHPAGIRI VITREO RETINA INSTITUTE
HYDERABAD

THE IMPACT SCORE CARD

+13
OPERATING IN REMOTE SNCUS ACROSS 13 DISTRICTS

+6277
BABIES SCREENED

+650
BABIES TREATED

+74 M USD
ECONOMIC IMPACT OF BLINDNESS BURDEN SAVED

2014	2018
WORKING ON ROP FROM	USING 3nethra neo SINCE

GOUTAMI EYE INSTITUTE

RAJAHMUNDRY, INDIA

LEVERAGING OUTREACH PROGRAMMES TO DELIVER TIMELY EYECARE TO NEWBORNS IN REMOTE AREAS

Goutami Eye Institute (GEI) located in Andhra Pradesh started with a single camera to carryout ROP screening. Their existing camera was expensive and heavy to move around for remote ROP screening. GEI started with a telemedicine based model to cover more government NICUs, private NICUs of East Godavari, West Godavari, Krishna, Guntur and Prakasam districts to prevent ROP related blindness.

In 2017, GEI bought Forus Health's 3nethra neo for ROP screening. They realised 3nethra neo is much more portable and can be easily carried even on a motorbike for conducting mobile screening in local government hospitals. Presently, the trained technicians from the hospital travel to far locations **using public transport** while carrying 3nethra neo for ROP screening.

Forus Health's 3nethra neo has been quite helpful due to its compactness and portability. GEI conducts free of cost ROP screening in Govt based NICUs and charges minimal from Pvt NICUs. A total of five 3nethra neo are currently being used .

80% of the population got benefited are from socio-economically weaker section. Screened babies who have been detected with problems are being referred to retina specialists and follow up ensured. Technician keeps frequent communication with patient's parents on their treatment.

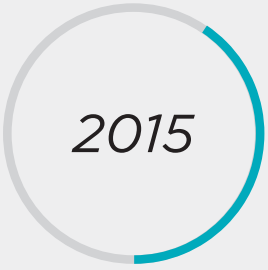
MESSAGE

"3nethra neo camera is compact and portable enabling our trained staff carry out remote screening programmes. We can easily carry 3nethra neo in public transport as well"

Dr. Y Srinivas Reddy

CHIEF MEDICAL OFFICER, GOUTAMI EYE INSTITUTE, RAJAHMUNDRY

THE IMPACT SCORE CARD



WORKING ON ROP. FROM

USING 3nethra neo SINCE

+13
OPERATING IN REMOTE NICUS ACROSS DISTRICTS

+12,912
BABIES SCREENED

+1067
BABIES TREATED

+121 M USD
ECONOMIC IMPACT OF BLINDNESS BURDEN SAVED

SUSHILA NETRALAY

SUSHILA EYE AND DENTAL HOSPITAL

AURANGABAD, INDIA

Aarambh ROP

SCREENING PROGRAMME, A COMMUNITY BASED APPROACH

India greatly suffers from lack of availability of ROP screening facility and non-availability of ROP Expert Ophthalmologist for screening babies. Preventing blindness from ROP is critical and achievable. In India, 3.5 million babies are born premature every year. Incidence of ROP is 40 to 50 % in babies who are born premature. This issue is prominent especially in rural or remote parts of India due to lack of availability of ROP screening facility and non-availability of Expert Ophthalmologist for screening babies. Preventing blindness from ROP is critical and achievable. Access to affordable and effective technology is needed for newborn care to avoid blindness.

With the help of Forus Health's 3nethra neo wide - field imaging system, Sushila Netralay has been able to scale **"Aarambh ROP Screening Programme"** to nearly 7 districts, across 35 NICUs where they screen 30 babies in each visit. Sushila Nethralay Team found 3nethra neo lightweight and portable making for easier transportation of a single unit between multiple NICUs.

3nethra neo images are of good quality and it helps in counseling parents of babies diagnosed with ROP and help them understand seriousness the same.

One of the major advantages of using 3nethra neo is that it enables our trained staff carry out mass screening programmes for ROP in remote areas

FH Telecare Forus health's tele-medicine platform allows doctors to review and provide diagnosis from anywhere thereby helping them focus on treatment.
This unique model can be adapted across India (especially in private sector) to curb incidence of ROP and huge burden of childhood blindness.

"I have been using 3nethra neo camera for ROP screening programme in Maharashtra for more than 2 years. One of the major advantages of using 3nethra neo is that it is compact and portable enabling our trained staff carry out mass screening programmes for ROP in remote areas"

DR SANTOSH AGARWAL

SUSHILA EYE AND DENTAL HOSPITAL
AURANGABAD

THE IMPACT SCORE CARD

REACHING OUT TO PRIVATE & GOVT NICUs ACROSS DISTRICTS

+ 4600
BABIES SCREENED

+152
BABIES TREATED

+17 M USD
ECONOMIC IMPACT OF BLINDNESS BURDEN SAVED

2018
WORKING ON ROP FROM

2018
USING 3nethra neo SINCE

MAKUNDA CHRISTIAN LEPROSY AND GENERAL HOSPITAL

KARIMGANJ, INDIA

TAKING ROP CARE TO THE UNREACHED IN THE STATE OF ASSAM

Programme benefiting marginalised communities in Karimganj district, Assam

Makunda Christian Leprosy and General Hospital (MCLG) is a 205 bedded NABH accredited secondary level charitable hospital located in Karimganj district of Assam. This hospital has been offering high quality perinatal care to people in and around this rural area since the time it was re-started in 1993. Over the last five years, MCLG has expanded its Pediatric services and extended more services under its scope. Most of their patients are from marginalized and vulnerable group, often from neighbouring tea gardens and refugee communities.

Their Neonatal Intensive Care Unit had a major transition and got expanded into a 19 bedded level II Unit. This NICU has been admitting an average of 120 neonates every month offering critical services like Invasive Mechanical Ventilation services, CPAP support for babies with respiratory distress, exchange transfusion for babies with severe Jaundice and so on.
This hospital has a lot of preterm babies admitted to NICU and Retinopathy of Prematurity (ROP) screening was a critical need in their NICU.

Earlier patients needed to travel to Guwahati, about 400Km drive for availing advanced screening facilities. Distance was an inconvenience and a deterring factor for parents to avail ROP screening facilities. At this juncture, MCLG got to know about 3nethra neo provided by Forus Health and requested their support. Considering the large number of preterm babies managed at Makunda, Sachin Tendulkar Foundation, Mumbai with support from Sri Sankara Deva Nethralaya, Guwahati a referral centre for Ophthalmology came forward to donate Forus Health's 3nethra neo Retinal Camera. Now Makunda can carryout ROP screening helping prevent possible blindness among neonates. Makunda over the last one year has screened close to **40 babies** for this dreadful problem that can cause blindness among tiny premies who fight against all odds to survive in this world.

2021| STARTED USING 3nethra neo

2021

WORKING ON ROP FROM

2021

USING 3nethra neo SINCE

"We have significant number of preterm births and admissions in our hospital. We are glad to have 3nethra neo installed and with its help carry out ROP screening at our center, saving parents time and effort to travel very far off distances and get their babies tested for ROP."

Dr. Shajin T

MD , DNB PEDIATRICS
HEAD DEPARTMENT OF PEDIATRICS
MAKUNDA CHRISTIAN LEPROSY AND GENERAL HOSPITAL

THE IMPACT SCORE CARD

OPERATING NICU

+ 40

BABIES SCREENED

+ 2

BABIES TREATED

+0.2M USD

ECONOMIC IMPACT OF BLINDNESS BURDEN SAVED

DR SANDEEP MITHAL ADVANCED PHACO REFRACTIVE & VITREO RETINA CENTRE

MEERUT, INDIA

PASSION DRIVEN ROP SCREENING SAVING BABIES FROM ROP BLINDNESS

Dr Kopal Mithal from Path & Eye Clinic, Meerut is extremely passionate about Retinopathy of Prematurity (ROP). At a very early stage of her training in ophthalmology, she realized her passion for research and understanding ROP. She got trained by her mentors Dr. Shashank Patel, Dr. Subhadra Jalali, Dr. Raja Narayanan and Dr. Avinash Pathangey.

Dr Kopal Mithal realised, a lifetime of disability due to ROP blindness could have been prevented with timely ROP screening and treatment. Dr Kopal spent the first two years visiting NICUs in and around city, meeting NICU staff and neonatologists. She received positive response from some places and sometimes she was challenged on whether she could provide results.

Dr Kopal Mithal had to rebuild screening & treatment protocols as a large percentage of the ROPs that she treated were severe sight threatening ROPs. Dr Kopal Mithal started visiting NICUs with an indirect ophthalmoscope and laser, often at odd hours of the night after her work routine. The satisfaction and fruits she got from ROP treatment built her courage as well as practice. In 2019, Dr Kopal Mithal bought a Forus Health's 3nethra neo, affordable digital wide filed imaging system with good results. With the help of 3nethra neo, she could document and offer screening to more NICUs within limited time. 3nethra neo has helped expand her ROP screening to more NICUs and thus reduce the socioeconomic burden due to ROP blindness.

"With the help of 3nethra neo camera, I was able to offer more NICU screening and document them in a limited time. 3nethra neo has helped in expanding ROP screening to more NICUs. This has helped us reduce ROP blindness burden"

Dr Kopal Mithal

RETINA SURGEON
DR. SANDEEP MITHAL ADVANCED PHACO-REFRACTIVE & VITREO-RETINA CENTRE, MEERUT

THE IMPACT SCORE CARD

2017 WORKING ON ROP FROM

2019 USING 3nethra neo SINCE

+5
OPERATING IN 5 NICUS ACROSS MEERUT

+2248
BABIES SCREENED

+434
BABIES TREATED

+49M USD
ECONOMIC IMPACT OF BLINDNESS BURDEN SAVED

EYE MICROSURGERY AND LASER CENTRE HOSPITAL

TIRUVALLA, INDIA

A PRIVATE HOSPITAL INITIATIVE FOR ROP CARE

Dr. Verghese Joseph

MEDICAL DIRECTOR
EYE MICROSURGERY AND LASER CENTRE HOSPITAL,
TIRUVALLA, KERALA

3nethra Neo has been of immense help in documenting various stages of retinopathy of prematurity. These images help in convincing both parents and neonatologists about retinal conditions of premature infants. Previously, neonatologists were sceptical that such a large number of infants under their care had ROP.
Images are passed on to parents to enable them get a second opinion too"

Eye Microsurgery and Laser Center, Thiruvalla, was established in 1990 and serves Pathanamthitta district, which is in the in the central Travancore region of Kerala. They have all sub specialities of ophthalmology. They have been doing ROP screening of premature babies in this hospital since 2005 and are associated with 3 NICU's of other hospitals. Pathanamtitta district is not economically backward as remittance comes from expatriates. Infants from Pathanamthitta district and surrounding districts are also screened.

THE IMPACT SCORE CARD

2005 WORKING ON ROP FROM

2020 USING 3nethra neo SINCE

+3
OPERATING IN 3 NICUS

+4400
BABIES SCREENED

+122
BABIES TREATED

+14M USD
ECONOMIC IMPACT OF BLINDNESS BURDEN SAVED

PRISM EYE INSTITUTE & RESEARCH CENTRE

PANVEL, NAVI MUMBAI, INDIA

Dr Mahesh Uparkar, an ophthalmologist located in Navi Mumbai with his immense drive started his ROP journey in the year 2012 as an independent practitioner with an aim to identify babies with ROP early, and prevent them from going blind.

He initially started his screening practice by visiting 3 to 4 NICUs in Navi Mumbai area. His biggest challenge was his inability to explain the need for repeated screenings to parents to make them understand the severity of problem at hand and convince them of treatment. This resulted in his objective of ROP screening not getting fulfilled.

Dr. Mahesh Uparkar bought Forus Health's 3Nethra Neo in the year 2019 to objectively identify retinal problems in babies and counsel parents. Dr.Mahesh uses digital retinal images of 3nethra Neo to effectively identify and communicate about the condition with the baby's parents. His practice has improved since.

"Using 3nethra neo camera's retinal images, I can effectively communicate with parents about their baby's condition and convince them of treatment needs"

Dr Mahesh Uparkar

OPHTHALMOLOGIST, PRISM EYE INSTITUTE & RESEARCH CENTRE , NAVI MUMBAI

THE IMPACT SCORE CARD

+7
OPERATING IN NICUS

+4000
BABIES SCREENED

+150
BABIES TREATED

+17 M USD
ECONOMIC IMPACT OF BLINDNESS BURDEN SAVED

ENGLEWOOD HEALTH, NEW JERSEY , USA

SREE JAGANNATH HOSPITAL & RESEARCH CENTRE

RANCHI, INDIA

Dr Vandana is a renowned ophthalmologist of Ranchi, Jharkhand. Dr.Vandhana does ROP screening in NICUs of Shree Jagannath Hospital & Research centre and Multi Speciality Hospital and Trauma centre. She is one of the first customer who tried their hands in using 3nethra neo and bought the camera later.

2017

WORKING ON ROP FROM

2020

USING 3nethra neo SINCE

THE IMPACT SCORE CARD

OPERATING NICUS IN RANCHI

+ 5025

BABIES SCREENED

+256

BABIES TREATED

+29M USD

ECONOMIC IMPACT OF BLINDNESS BURDEN SAVED

PRAYAG RETINA CARE CLINIC

PRAYAGRAJ, INDIA

"Using 3nethra neo I am able to train my technicians to conduct ROP screening outside. Whenever, we are unable to go for ROP screening, we will send our team for remote screening"

Dr Manish Tandon
PEDIATRIC OPHTHALMOLOGIST
ALLAHABAD, INDIA.

2017

WORKING ON ROP FROM

2019

USING 3nethra neo SINCE

Prayag Retina Care Clinic is led by Dr Manish Tandon, a pediatric ophthalmologist located in Allahabad. He was part of Aravind Eye Hospital for 12 years and was heading their pediatric department under Dr R Kim. In 2017, he moved back to Allahabad and started his own ROP practice.

Within a period of 1 year, he analysed visiting patient's data and found a shocking insight that of 74 babies screened, 55% were blind with ROP stage 5. This was much higher than 10% in babies while he was working in Madurai.

Dr. Manish approached Indian pediatric association branch in Allahabad where they acknowledged his ideas. Later with financial help from his mother Dr. Sarala Tandon, he created educational pamphlets and charts and conducted many CME's for neonatologists and obstetricians. Dr. Manish also created awareness about ROP among the general people using FM, pamphlets in his own city. Post covid, hospital is screening around 100 babies a month. In 2019, doctor bought Forus Health's 3nethra neo which helped him train his technicians conduct ROP screening outside. His team carries out remote screening in his absence.

+4
OPERATING IN REMOTE NICUS ACROSS 3 DISTRICTS

+2287
BABIES SCREENED

+189
BABIES TREATED

+21M USD
ECONOMIC IMPACT OF BLINDNESS BURDEN SAVED

TILGANGA INSTITUTE OF OPHTHALMOLOGY

KATHMANDU, NEPAL

Tackling blindness in Newborn with Outreach Screening Programme IN HIMALAYAS

Tilganga Institute of Ophthalmology is one of the oldest and reputed institute in Nepal who have played a significant role in providing quality eye care in Nepal since 1994. It is a not-for-profit, community-based organization known for providing affordable and quality eyecare in Nepal.

Neonatal care has drastically improved in Nepal, with more survival of extremely premature babies, incidence of treatment requiring ROP has been increasing rapidly.
Tilganga Institute bought a Forus Health's 3nethra neo (wide filed imaging system) in 2017 for conducting ROP screening in the Nepal government hospitals and medical colleges across the 3 districts. Tele-screening by non-ophthalmologists with the use of 3nethra neo and FH Telecare tele-ophthalmology software has addressed early detection of sight threatening retinopathy of prematurity (ROP).

Comprehensive ROP management program has started in Kathmandu valley from Tilganga Institute of Ophthalmology since 2017. This USAID supported project was coordinated by Dale Davis (Country Director, Helen Keller International, Nepal) and led by Dr. Bajimaya. Annually 300 to 400 premature babies are being screened from three large NICUs of Kathmandu and babies that requires Anti-VEGF injections or Laser are being referred to base hospital.

"3nethra neo is very helpful for a developing country like Nepal, where there are very less number of ophthalmologists. 3nethra neo is best utilized by mid-level health personnel for screening at NICUs while we focus on treatment"

Dr Sanyam Bajimaya

VITREO-RETINA SURGEON
TILGANGA INSTITUTE OF OPHTHALMOLOGY, NEPAL

IMPACT SCORE CARD

Reaching out to remote NICU's

+700
Babies Screened

+50
Babies treated

+3M USD
Economic Impact of Blindness Burden saved

2017
WORKING ON ROP FROM

2018
USING 3nethra neo SINCE

AL FERDAWS EYE HOSPITAL EGYPT

ROP SCREENING FOR PREMATURE BABIES IN EGYPT

Dr Sara Tawfik, a pediatric ophthalmologist from Al Ferdaws Eye Hospital in Egypt has been practising ROP for a long time. Al Ferdaws Eye Hospital is a reputed eye hospital providing various eyecare services in Egpyt.

She has been using Forus Health's 3nethra neo wide-field imaging system for conducting ROP screening. She says that Forus Health's 3nethra neo camera is easily installed and connects to mostly any computer device. Software is very friendly and efficient with smooth and rapid capturing speed and quality. 3nethra neo can capture nearly all zones of the fundus with adequate rotation and indentation. 3nethra neo's compactness and portability makes it an ideal candidate to carry across multiple NICU's and comes with great affordable price.

“Forus Health’s 3nethra neo camera is easily installed and connects to mostly any computer device. Software is very friendly and efficient with smooth and rapid capturing speed and quality. 3nethra neo camera can capture nearly all zones of the fundus with adequate rotation and indentation”

Dr Sara Tawfik

PEDIATRIC OPHTHALMOLOGIST
AL FERDAWS EYE HOSPITAL
EGYPT

AL MASHREQ EYE CENTER, EGYPT

“Forus Health’s 3nethra neo camera allows you to screen a large number of patients without fault or system break down. It has quite an easy interface and is amazingly portable.”

Dr. Ahmed Habib
VITREO RETINAL PROFESSOR
AL MASHREQ EYE CENTER

DOCTORS VOICE

From Dakar Senegal, Africa

Paule Roth Ndoye (Professor)
Hospital Aristide Le Dantec,
Dakar Senegal

52 children havebeen examined since 2019

"La caméra du fond d'oeil 3 nethra néo a été d'un grand apport pour nous, dans le diagnostic et le suivi des enfants atteints de pathologie rétinienne, en particulier le rétinoblastome. Par sa facilité d'utilisation et de maniement, elle peut être utilisée par un senior, un étudiant ou même un technicien. Elle permet de visualiser la rétine centrale et la rétine un peu au-delà de l'équateur, voire davantage selon l'orientation du globe oculaire au cours de l'examen."

Translation:

3nethra fundus camera has been of great help to us since 2019, for screening and follow-up of retinal pathologies in children, especially for retinoblastoma. Thanks to its ergonomy and user-friendliness, it can be used by a senior consultant, a junior or a technician. It helps to visualize the central retinaand the retina a little beyond the equator, or even more depending on the orientation of the eyeball during the examination.

3nethra neo IN THE UK

Forus Health launched 3nethra neo in Europe in 2018 after receiving CE marking and its very first installation was at one of the NHS hospitals in United Kingdom. National Health Service is a publically funded healthcare system in UK, and is the second largest single payor healthcare system in the world. UK has approximately 600,000 live births every year of which 10-13% are born preterm and NHS health system has about 200 Neonatal Intensive Care Units (NICU) that support neonatal care and ROP management. Within 4 years, NHS adopted 28 cameras in 17 different locations to improve efficiency in ROP management. A few sites have mobile screening programs that have increased the access to care. Selected hospitals have also started using 3 nethra neo in telemedicine based ROP screening programs that will not only improve access but also cost optimization. Our regional distributor Spectrum Opthalmics has played a crucial role in successfully marketing 3nethra neo and making it the fastest moving wide-field imaging system for ROP screening in UK.

"Forus Health is a great company to work with, and 3nethra neo HD FA is a fantastic product. We have a lot of success with the camera and its usability, portability, FA capabilities, and 150 degree viewing angle, making it the gold standard for ROP screening in our market. We get outstanding support from Forus Health with our installation, networking and technical service needs, which allows us to concentrate on keeping our customers happy"

- David Killengray,
CEO Spectrum Ophthalmics

3nethra neo IN THE UK

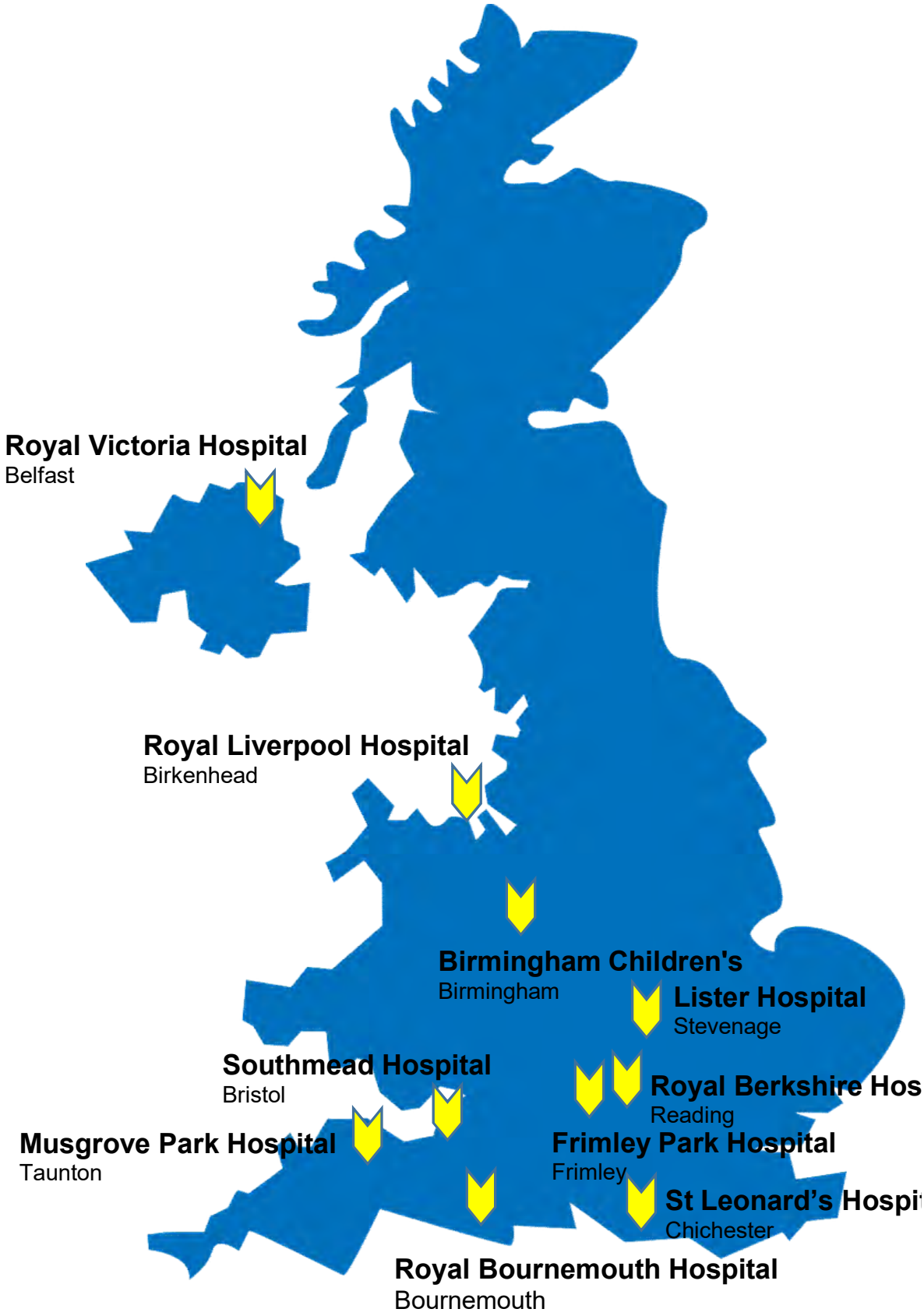
The quality of care has tremendously improved at our customer sites in the UK, and the doctors now have capacity to educate parents about serious eye conditions affecting their children with the help of an evidence based diagnostic system. It has also improved access to care as 3nethra neo system is now used as part of a telemedicine based ROP screening program that involves ophthalmic imaging technicians and nursing staff obtaining images which are reviewed in 'real time' by ophthalmologists to provide a report in a time frame that is suitable to families and neonatal staff. Roughly more than 25,000 babies have been screened at all the NHS hospitals having an active 3nethra neo installation.

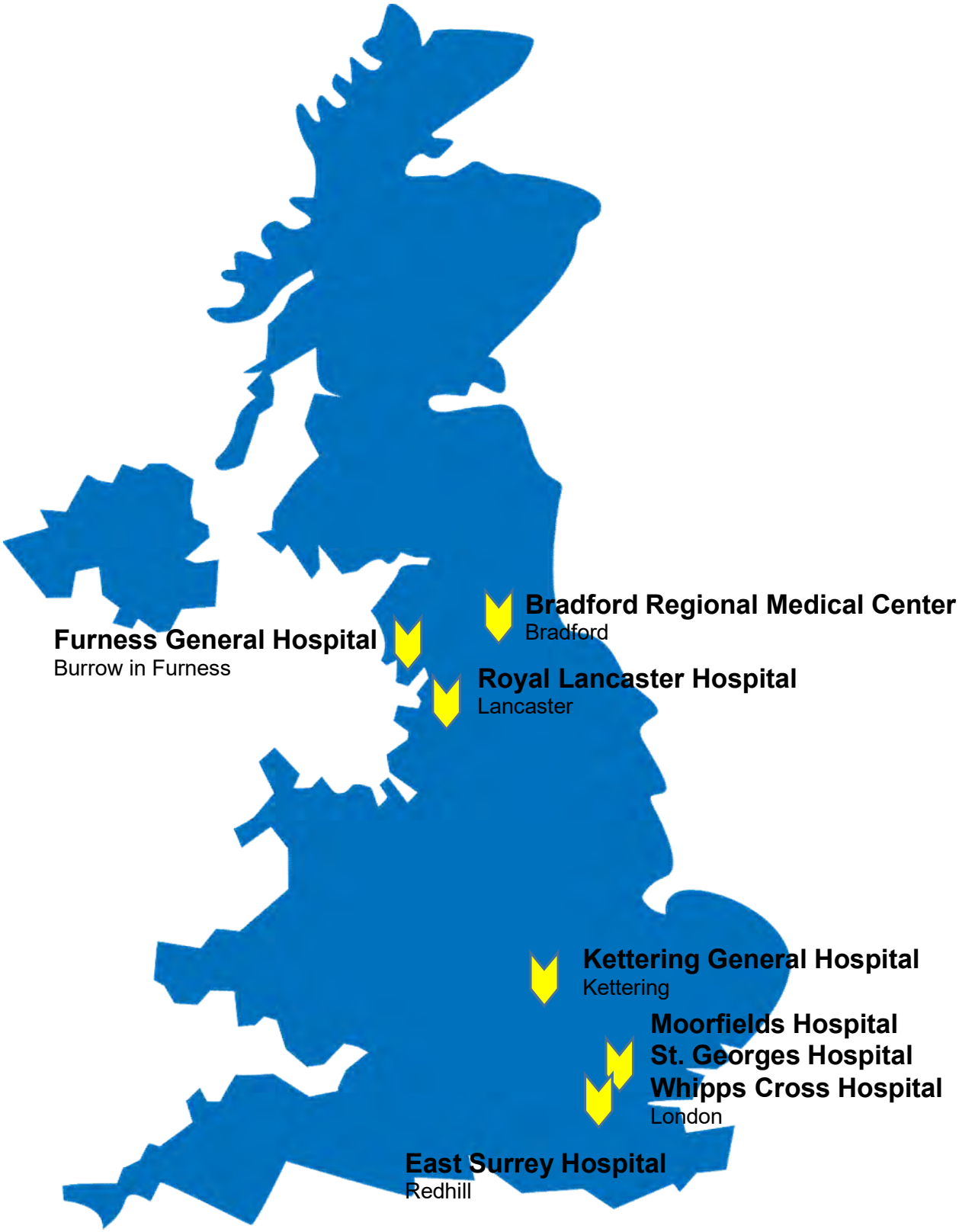
"I was new to Forus Health's 3nethra neo when starting in Bristol but had been familiar with a number of different ROP retinal imaging modalities prior to this. I found the learning curve to be very quick and have taken extremely good anterior and posterior segment images. With regards to ROP, 3nethra neo has been very useful at documenting the extent and stage of ROP, facilitating decisions regarding treatment, for sharing images between ophthalmologists and for teaching. I've used

3nethra neo for ROP and non-ROP imaging including retinal dystrophy, non-accidental injury, congenital glaucoma and lens abnormalities. I look forward to using the fundus fluorescein angiography module now that this is available"

- Dr. Arundhati Dev Borman,
Consultant in Pediatric Ophthalmology,
University Hospitals Bristol and Weston NHS Foundation Trust, UK

28 Installations




Furness General Hospital
Burrow in Furness
Bradford Regional Medical Center
Bradford
Royal Lancaster Hospital
Lancaster
Kettering General Hospital
Kettering
Moorfields Hospital
St. Georges Hospital
Whipps Cross Hospital
London
East Surrey Hospital
Redhill

17 sites

3nethra neo IN THE UK

On being introduced to 3nethra neo HD

"There's nothing I don't love about this. What more can I ask for!"

Dr Lloyd Bender

Consultant Ophthalmologist
St. George's Hospital
Moorfields


neo HD FA

3nethra neo in Europe

Forus Health also expanded into other territories in Europe with a lot of initial interest coming from regional distributors in France, Italy and Spain. With the 2nd installation in France, the product gradually found its way into other regions over time. Europe has 4 million births every year, and each country has their own unique challenges when it comes to ROP screening, be it shortage of ROP specialists, low population density, access to care, high cost of screening etc. 3nethra neo with its affordable, portable and telemedicine advantages can positively impact those challenges.
With the launch of 3nethra neo HD FA, our ultra wide-field imaging system with 150 FOV and FA in 2021, we have become the No: 1 choice when it comes to Pediatric Retinal Camera in continental Europe. The product is now available through our distribution channels based in Spain, Italy, France, Slovenia, Netherlands, Czech Republic and Russia.
The first 3nethra neo installations in Spain were at Hospital Sant Joan de Déu Barcelona, a teaching hospital specializing in pediatrics, gynaecology and obstetrics. One of 3nethra neo cameras is used in the surgery room for retinoblastoma screening, while the other unit is dedicated to ROP screening in a mobile program that moves between five hospitals.

"I am involved in the commercialization of wide-field pediatric cameras for diagnosing ocular diseases in infants since 2005. When Forus Health introduced their new pediatric camera in the market I was excited to introduce the new technology in Spain. It was still an evolving product at the time, but the team in Bangalore collected a lot off feedback from the market and eventually developed a model called
3nethra neo HD FA. With 150 degrees FOV, 20 MP colour camera, 5 MP FA camera and new DICOM features, this is the most advanced ultra wide-field imaging system in the world - the team at Forus Health is always proactive to collect information from the market and help improve customer experience"

– Antonio Castilla, IFF Service, Barcelona

The first 3nethra neo installation in Italy was at the Istituto Giannini Gaslini, Genoa which is one of the biggest pediatric hospitals in North Italy. 3nethra neo HD FA is used for both ROP management and retinoblastoma screening.

"Thanks to the new optics with 150 ° FOV, 20MP sensor, the availability of the FA module and the European CE certification, the market responded immediately leading to the first sale of 3nethra neo HD FA in Italy at the Giannina Gaslini Institute of Genoa with the department of Ophthalmology directed by Dr. Massimiliano Serafino. Equipped with the most advanced specifications for any product in its category, we are expecting exponential growth in Italy and other parts of Europe"

– Guido Vezzani, GV Oftalmologia, Milan

We

See

Show

Solve

Save

IMAGE ATLAS

3nethra neo

What 3nethra neo can show to the world

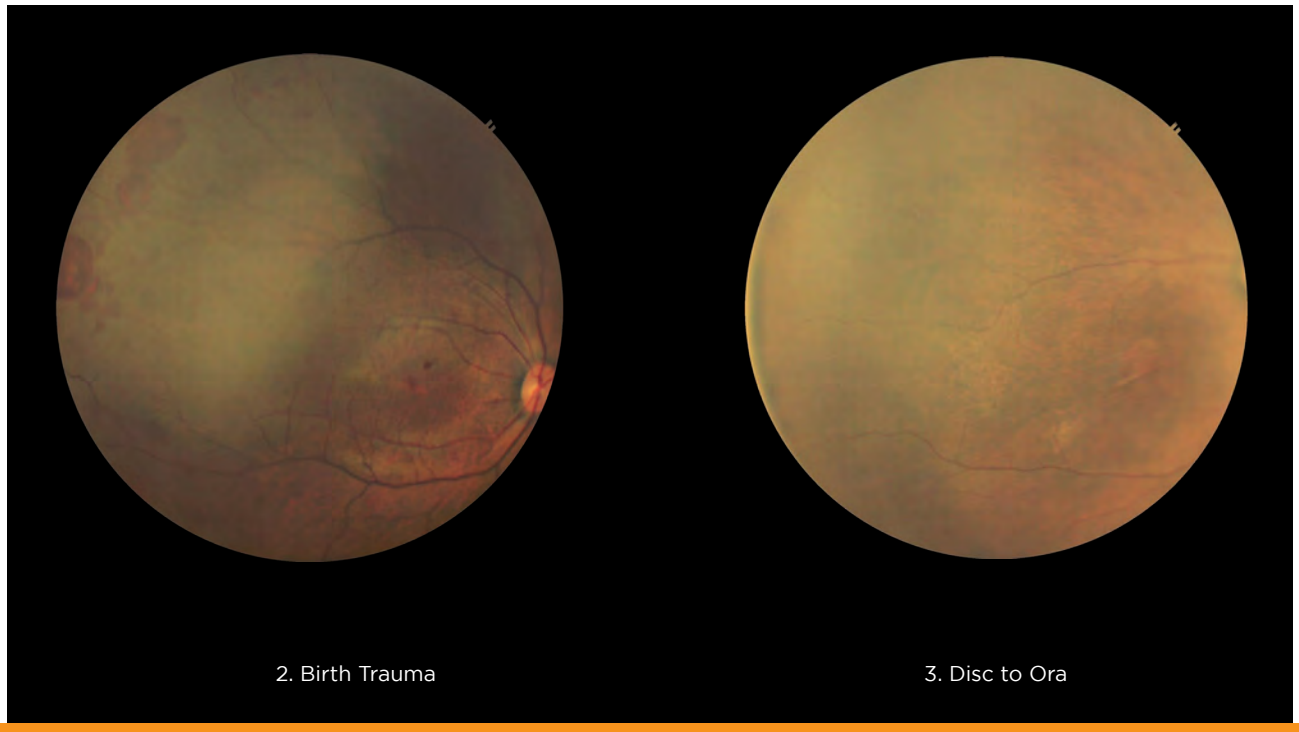
1. **Albinotic Fundus:**
The fundus is hypopigmented. Systemic Features: The hair is golden-colored and the skin is described as white. The specific gene causing this form of oculocutaneous albinism has not been identified.

2. **Birth Trauma:**
Birth trauma' is distress experienced by a mother during or after childbirth. While trauma can be physical (see Birth injury), it is often emotional and psychological. Birth trauma is not just about what happened during labour and the birth. It can also refer to how you, as the mother, are left feeling afterwards.

3. **Disc to Ora:**
Ora serrata is the peripheral termination of the retina and lies approximately 5 mm anterior to the equator of the eye.

Image Credits - Narayana Nethralaya, Aravind Eye Hospitals, Sankara Netralaya,

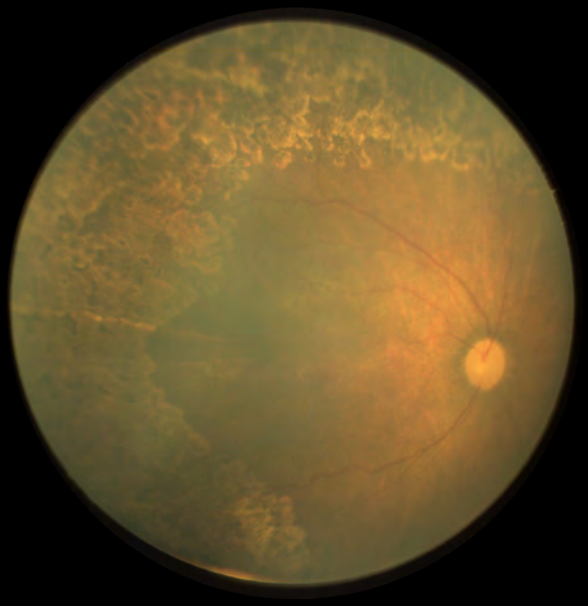
1. Albinotic Fundus



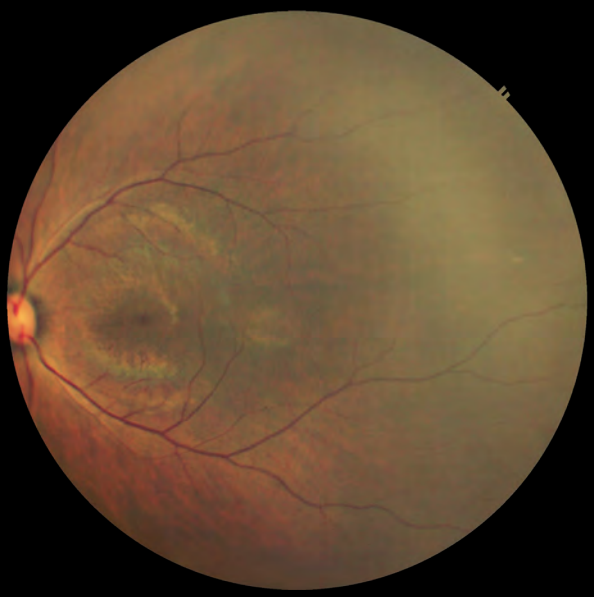
2. Birth Trauma

3. Disc to Ora

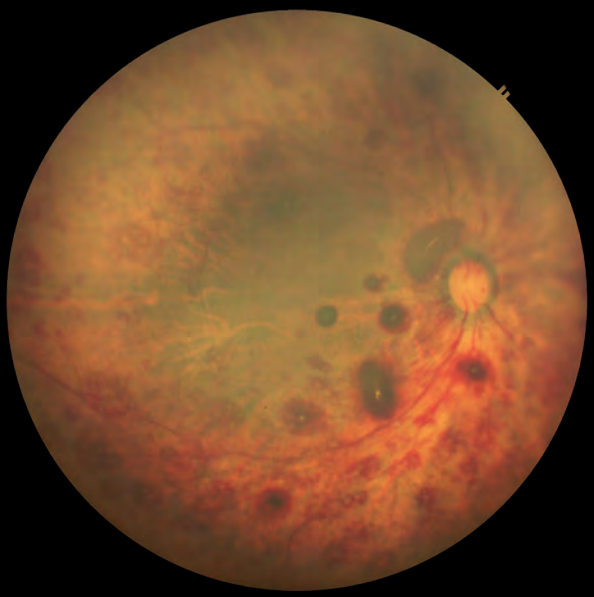
Retina as seen through 3nethra neo camera,
of Forus Health



4. Lasered Regressing



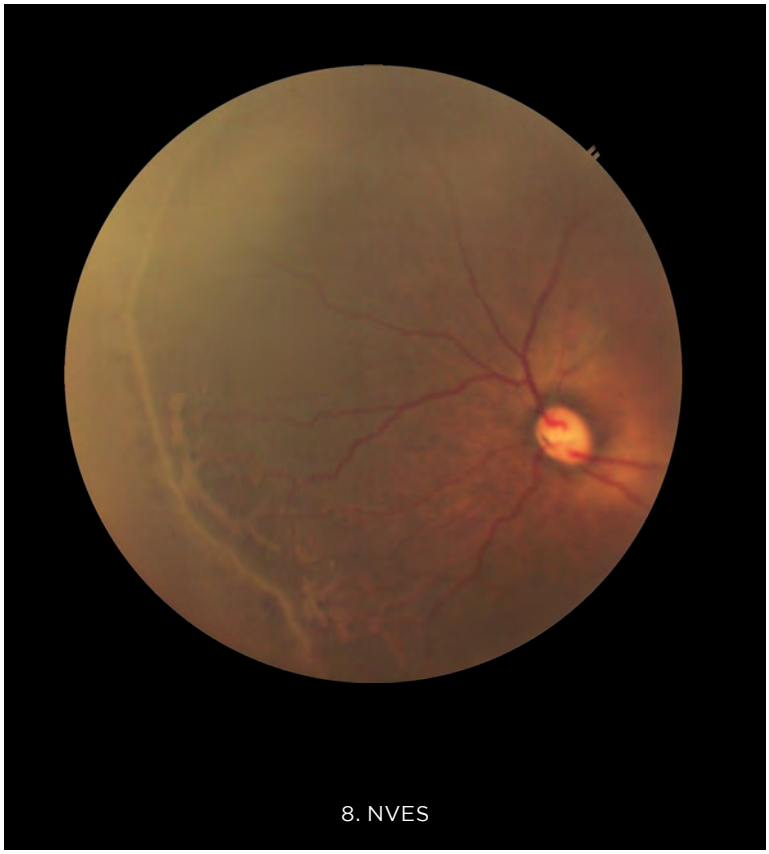
5. Mature Retina



6. Multiple Preretinal Hemorrhage

7. Nasal NVE

Image Credits - Aravind Eye Hospital



8. NVES

RETINA LANDSCAPES

4. **Lasered Regressed :**
Refractive regression after LASIK is mainly caused by corneal protrusion rather than postoperative central corneal thickening or RBT. Study indicated that myopic regression after LASIK was correlated with a low RBT preoperatively.

5. **Mature Retina :**
Maternal and neonatal factors were ascertained and analysed. Results: Vascularization up to zone I and II was considered to be immature retina; vascularization up to zone III or beyond was considered to be mature retina.

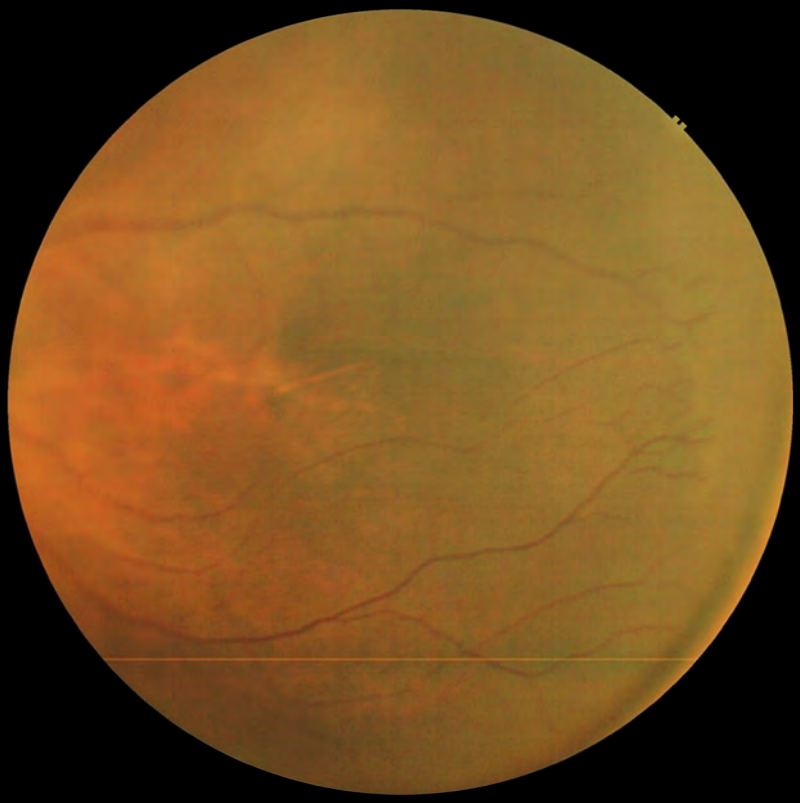
6. **Multiple Preretinal Hemorrhage :**
Preretinal hemorrhages are “boat” or ‘D’ shaped hemorrhages which collect between the posterior limiting membrane of the vitreous and internal limiting membrane (ILM) of the retina.

7. **Nasal NVE :**
Retinal neovascularization occurs when there is retinal ischemia and leads to release of angiogenic factors like VEGF. Retinal neovascularization that occur within 1 disc diameter (DD) is considered as neovascularization of the disc and if further than 1 DD away, classified as neovascularization elsewhere (NVE).

8. **NVES**
Retinal neovascularization occurs when there is retinal ischemia and leads to release of angiogenic factors like VEGF. Retinal neovascularization that occur within 1 disc diameter (DD) is considered as neovascularization of the disc and if further than 1 DD away, classified as neovascularization elsewhere (NVE)

9. Plus Disease - 1

10. Plus Disease - 2



11. Peripheral Avascular Retina

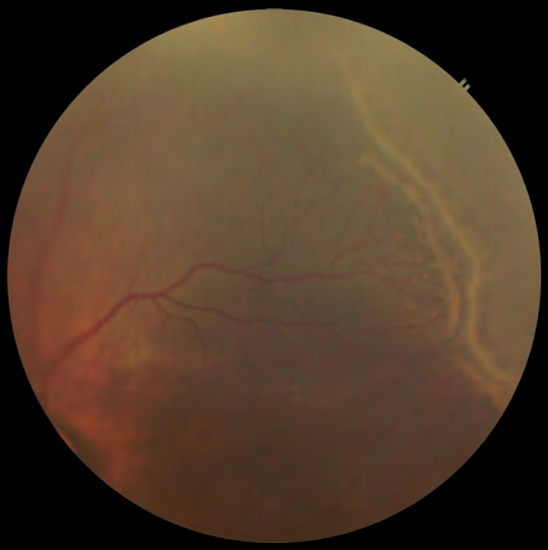
Image Credits - Aravind Eye Hospital

9-10. **Plus Disease**
Plus disease describes the most severe vascular changes of dilation and tortuosity and is associated with severe ROP and visual morbidity if left untreated. The diagnosis of plus disease is historically a dichotomous decision based on subjective comparison to reference images.

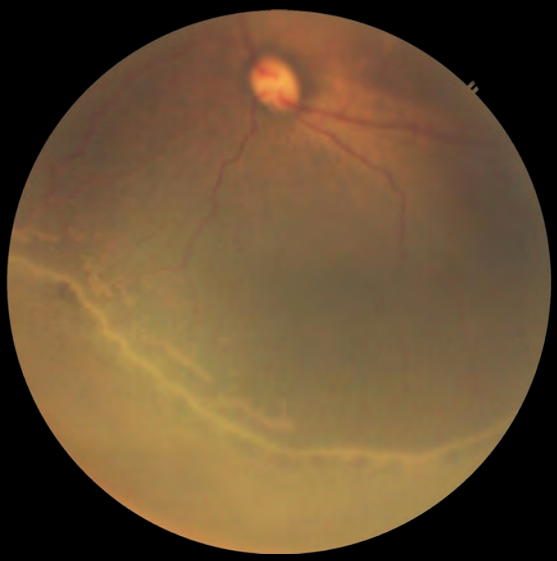
11. **Peripheral Avascular Retina :**
The avascular peripheral retina in ROP likely produces vascular endothelial growth factor (VEGF), which in turn induces pathological angiogenesis at the advancing margin of developing retinal blood vessels.

12. **Peripap Hmge:**
is a disorder of the eye in which bleeding occurs in the retina, the light sensitive tissue, located on the back wall of the eye.

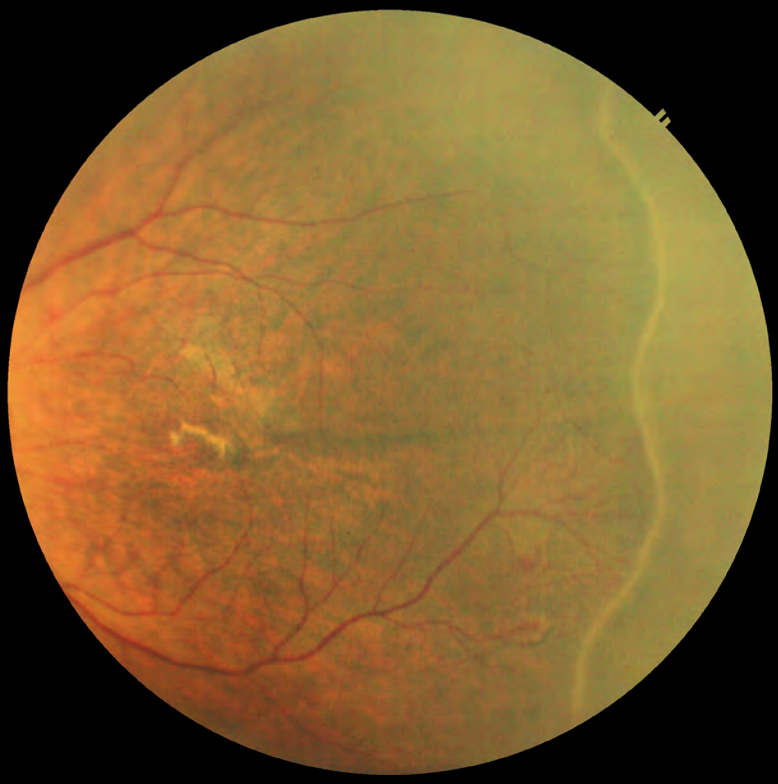
12. **Peripap Hmge**



13. Prominent Popcorn Lesions

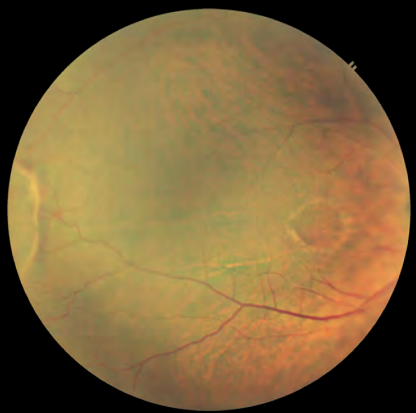


14. Prominent Stage 3



15. Prominent Popcorn Lesions - Stage 2

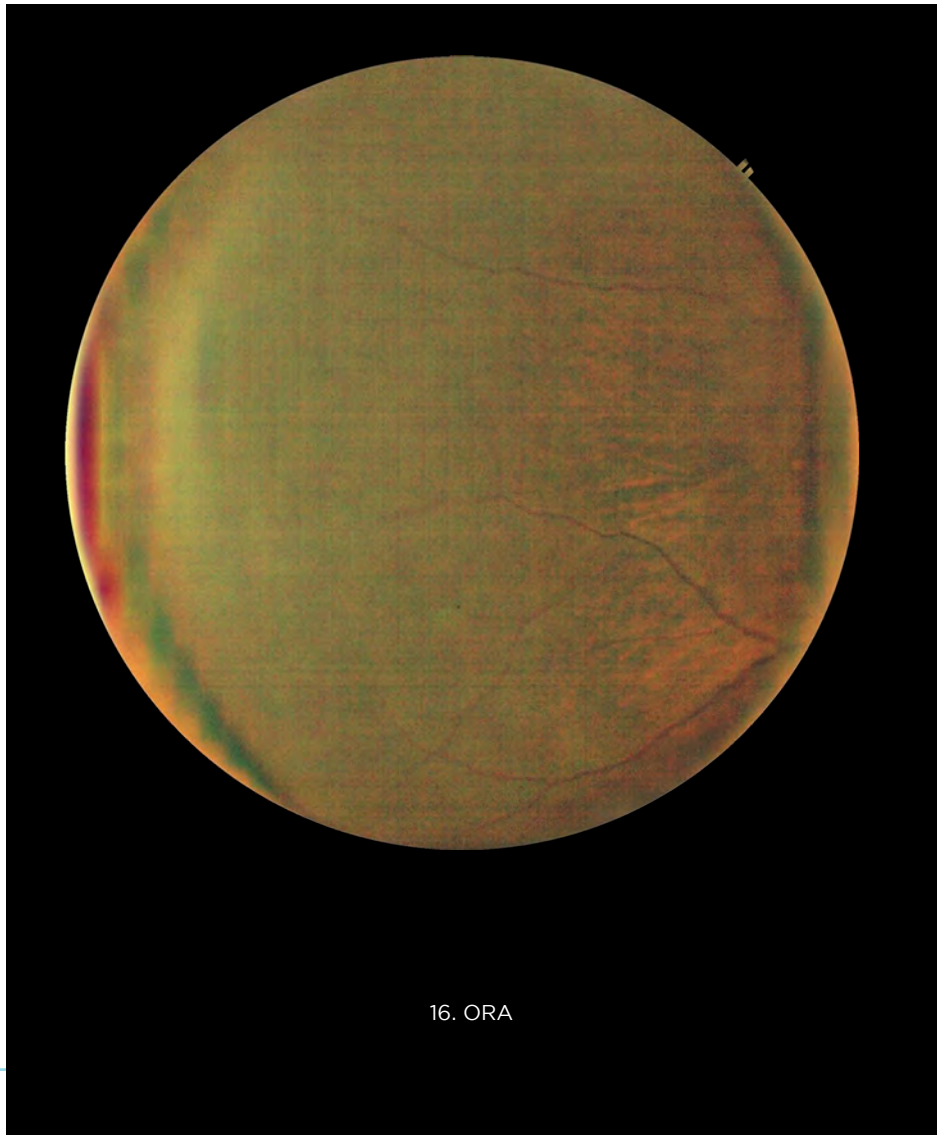
Stage 3



Stage 3

The vision
Retinal Evaluation

14. **Peripheral Avascular Retina :**
The presence of popcorn significantly increases the risk that an eye with zone II, stage 2 ROP will progress to stage 3, develop plus disease, and require laser treatment. Patients with popcorn and coexistent mild vascular dilation or tortuosity insufficient for plus disease are at particularly high risk for disease progression.



16. ORA

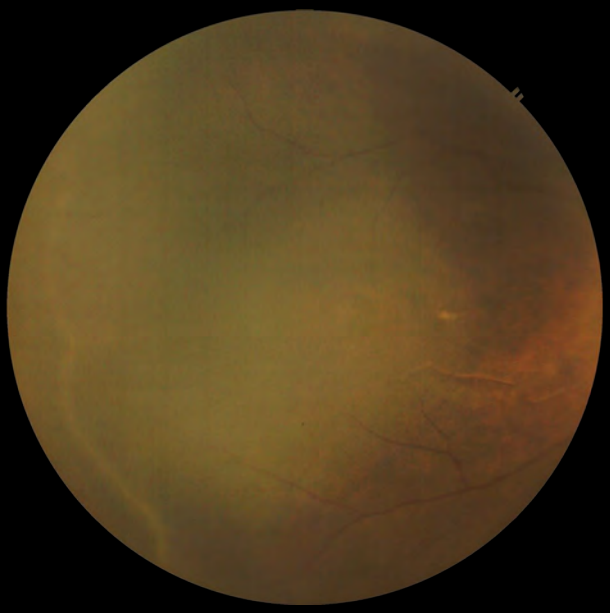
Zone

Zone 1 is the most posterior (or most central) retina.

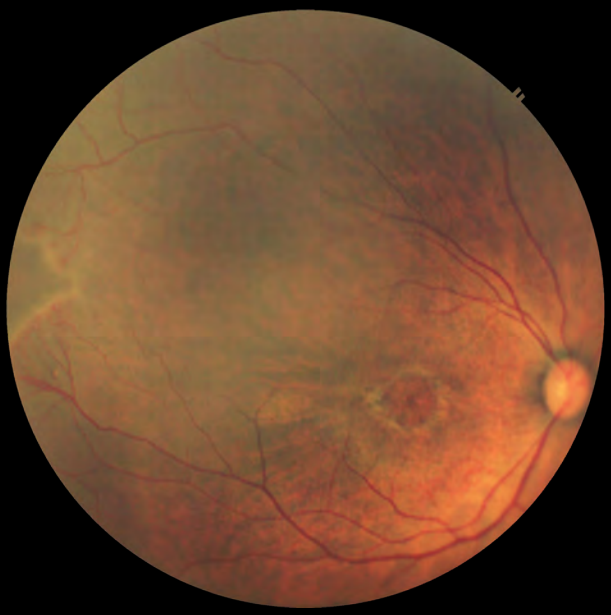
Zone 2 is the intermediate (between the posterior and peripheral) retina.

Zone 3 is the peripheral (or outer) retina.
The retinal vessels begin to develop in zone 1 and then gradually grow outward to the retinal periphery until reaching zone 3; thus, zone 1 involvement is more severe than zone 3 involvement.

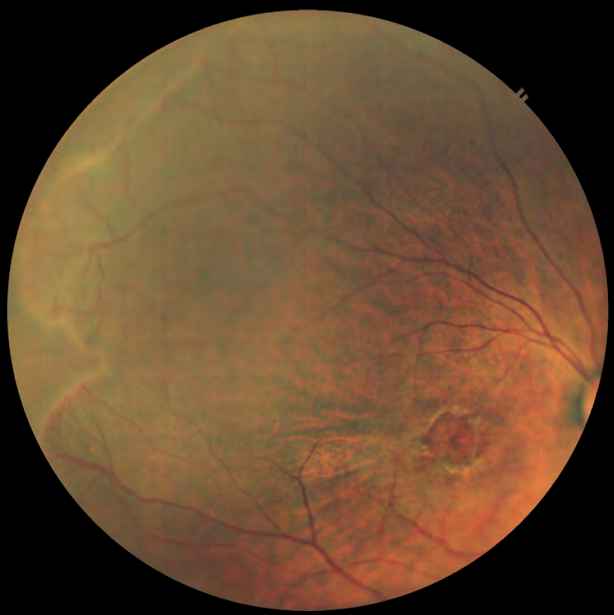
17. Zone 3



18. zone 3 stage 2.

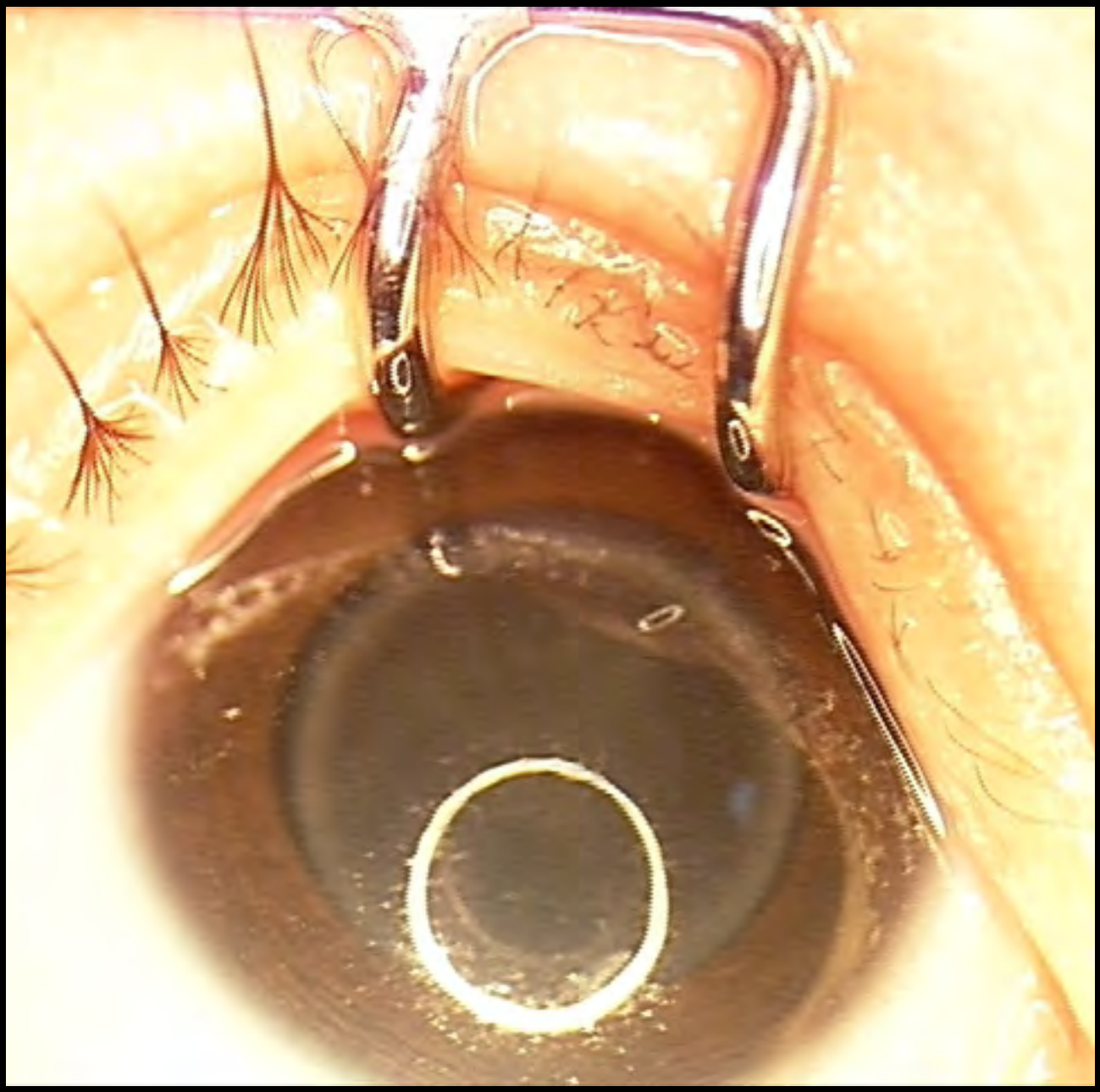


19. zone 3 stage 3 popcorn vessels



20. zone 3 stage 3 v

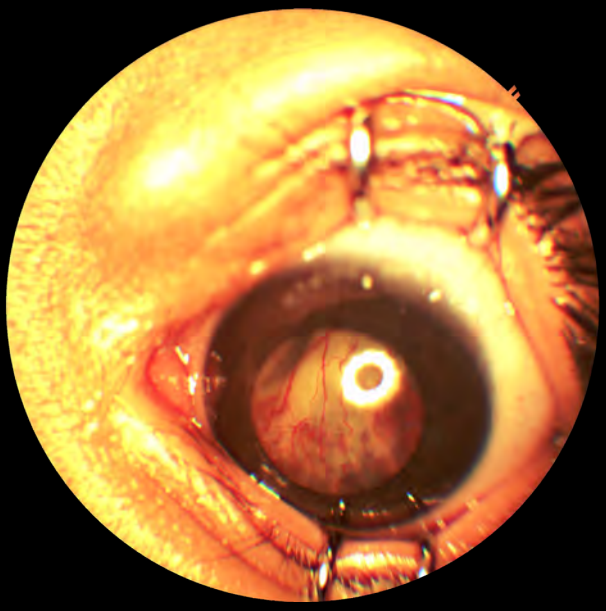
Zone 3



Anterior segment showing an annular ring of a cataract

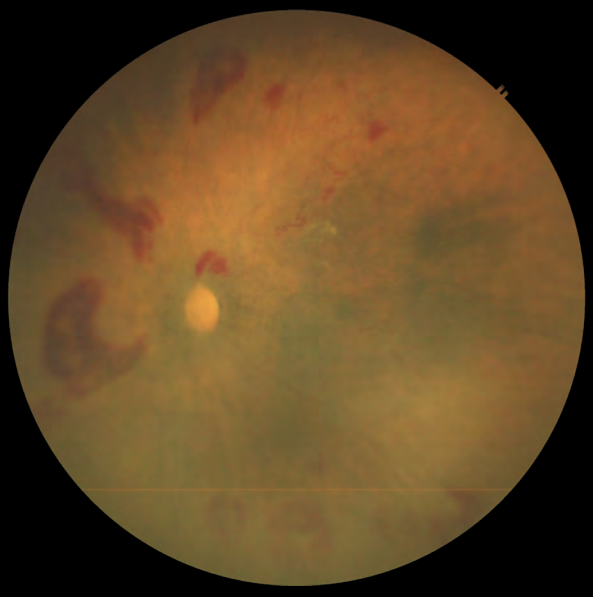
Image Credits - Narayana Nethralaya

External apperance of the left eye showing an exudative retinal detachment causing leucokoria



Left eye chorioretinal coloboma

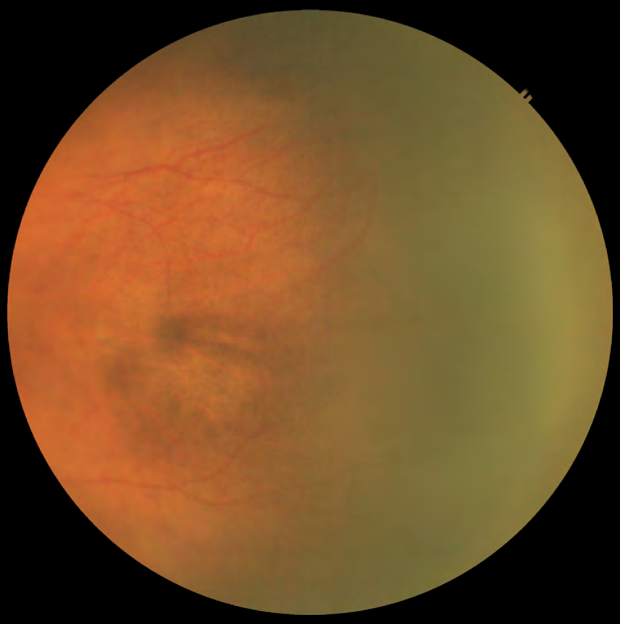
Left eye occluded subtype of aggressive ROP before treatment



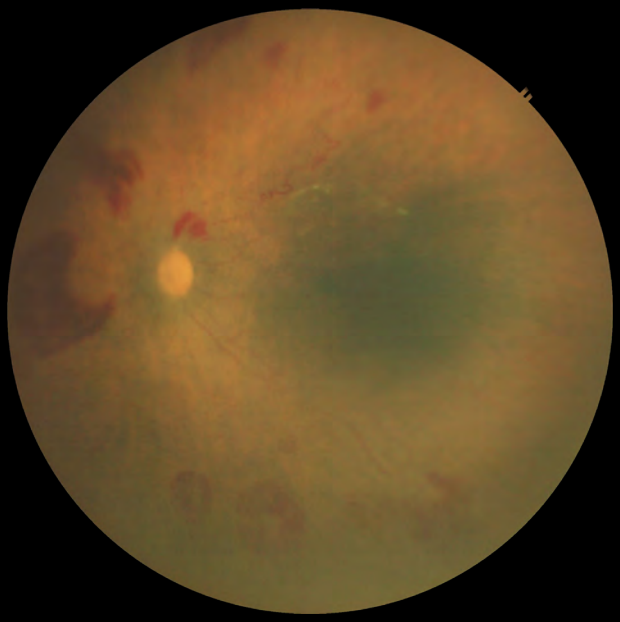
Left eye showing multiple retinal exudative folds and telengiectasia suggestive of Coats disease

Image Credits - Narayana Nethralaya

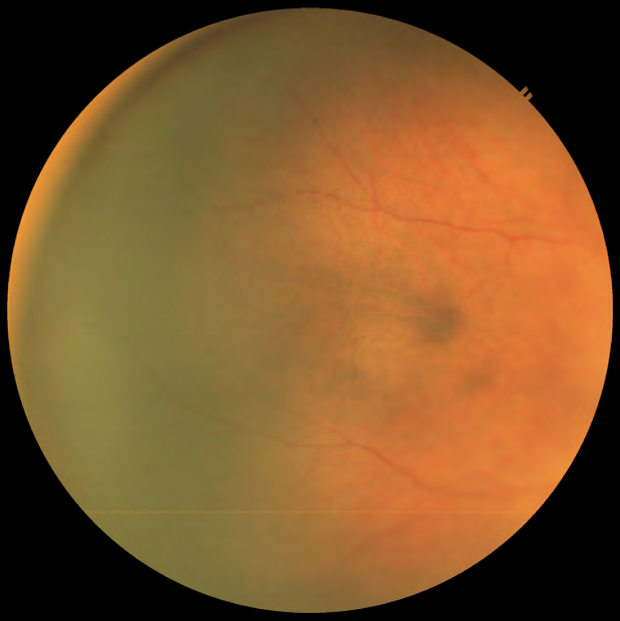
Left eye temporal quadrant with incomplete vascularization upto zone 2 anterior



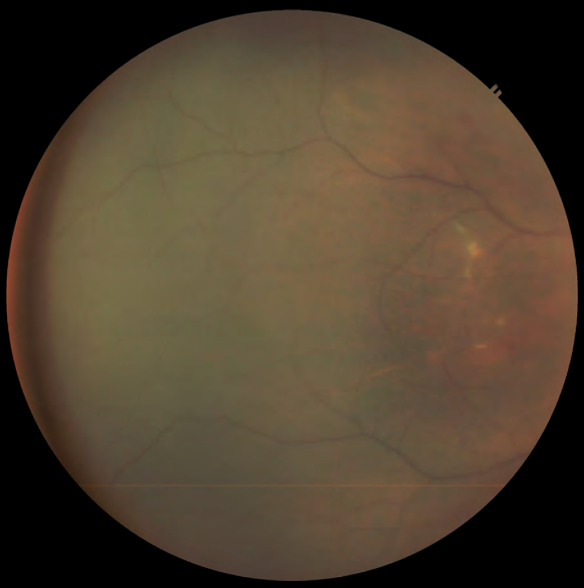
Left eye with occuded subtype of aggressive ROP a week after anti VEGF



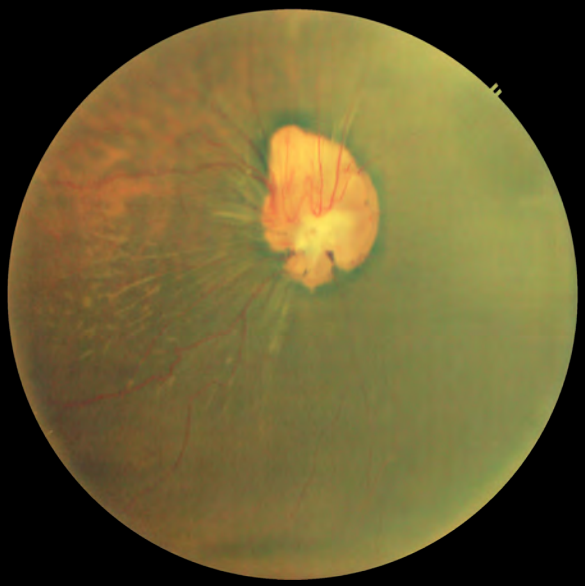
Mature retina termporal quadrant of the right eye



Right eye Aggressive Retinopathy of Prematurity (AROP) in posterior zone 1

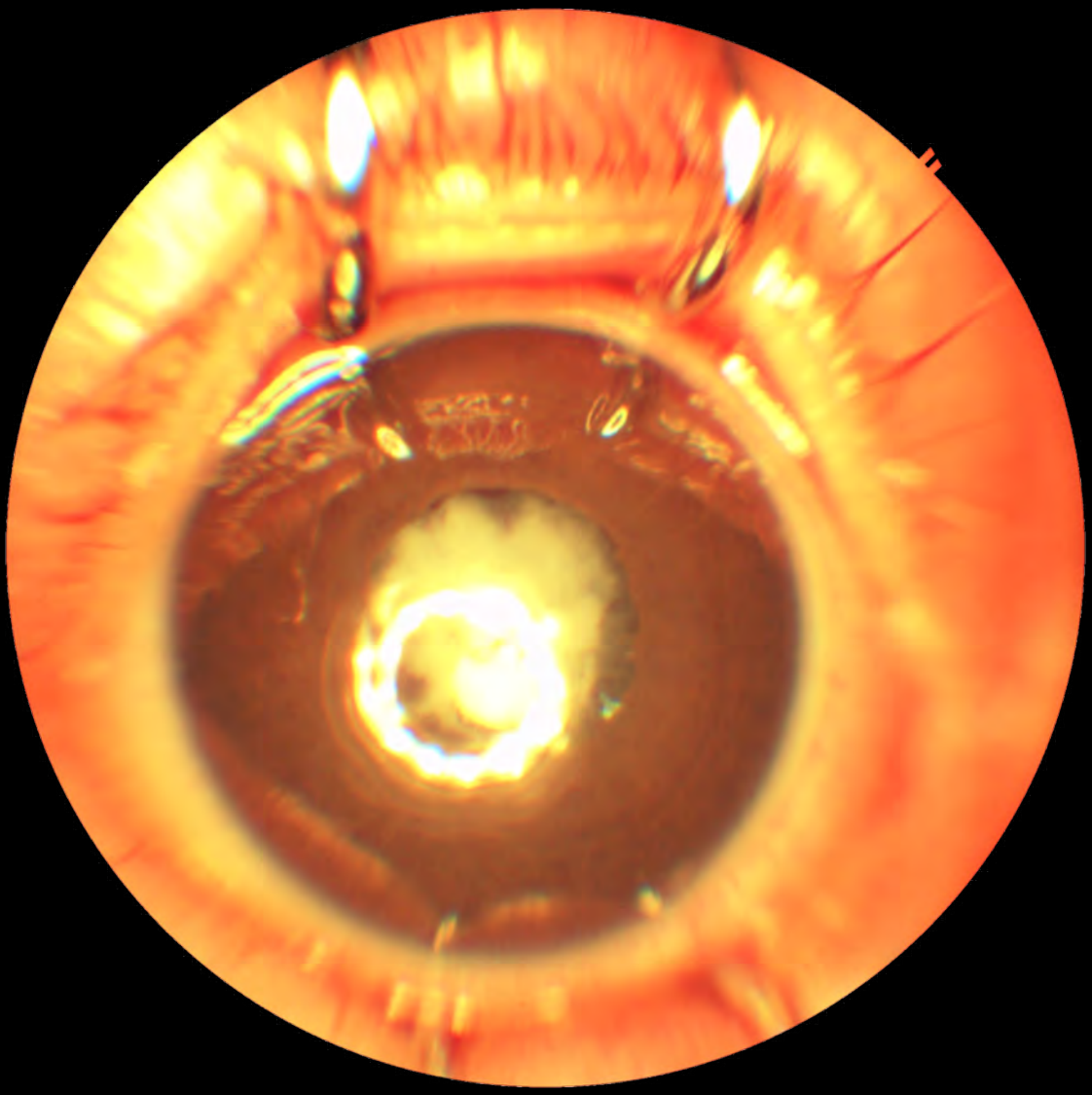


Mature retina, temporal quadrant of the right eye

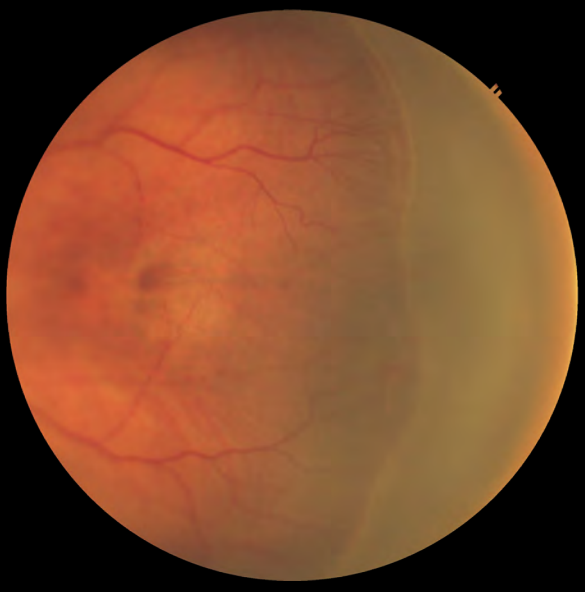


Mature retina, temporal quadrant of the right eye

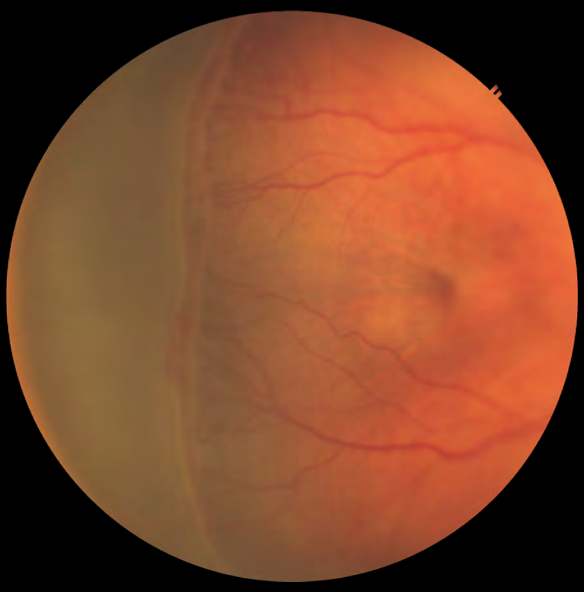
Image Credits - Narayana Nethralaya



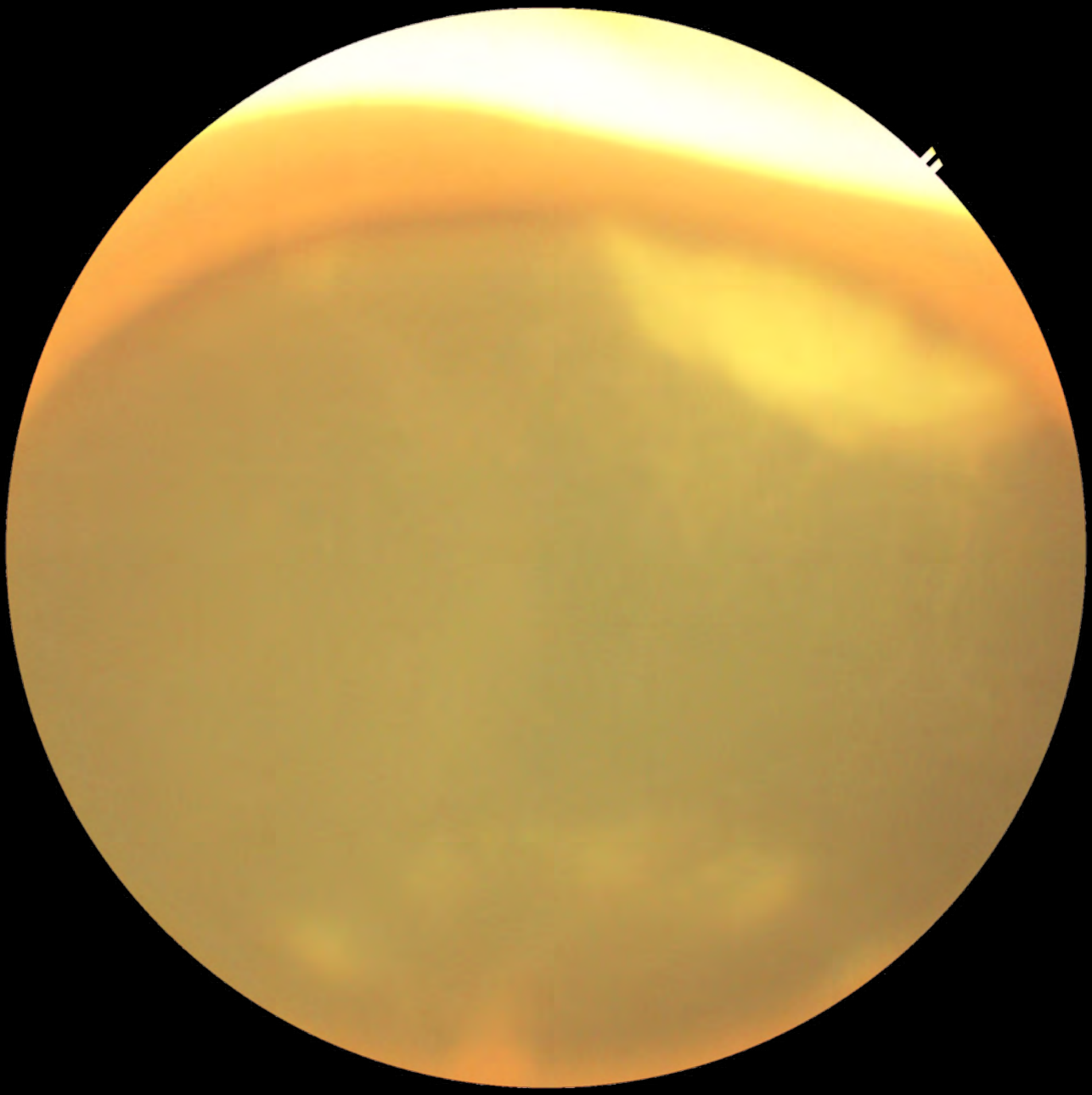
Right eye cataract associated with
persistent fetal vasculature syndrome



ROP stage 2 with popcorn in
the left eye

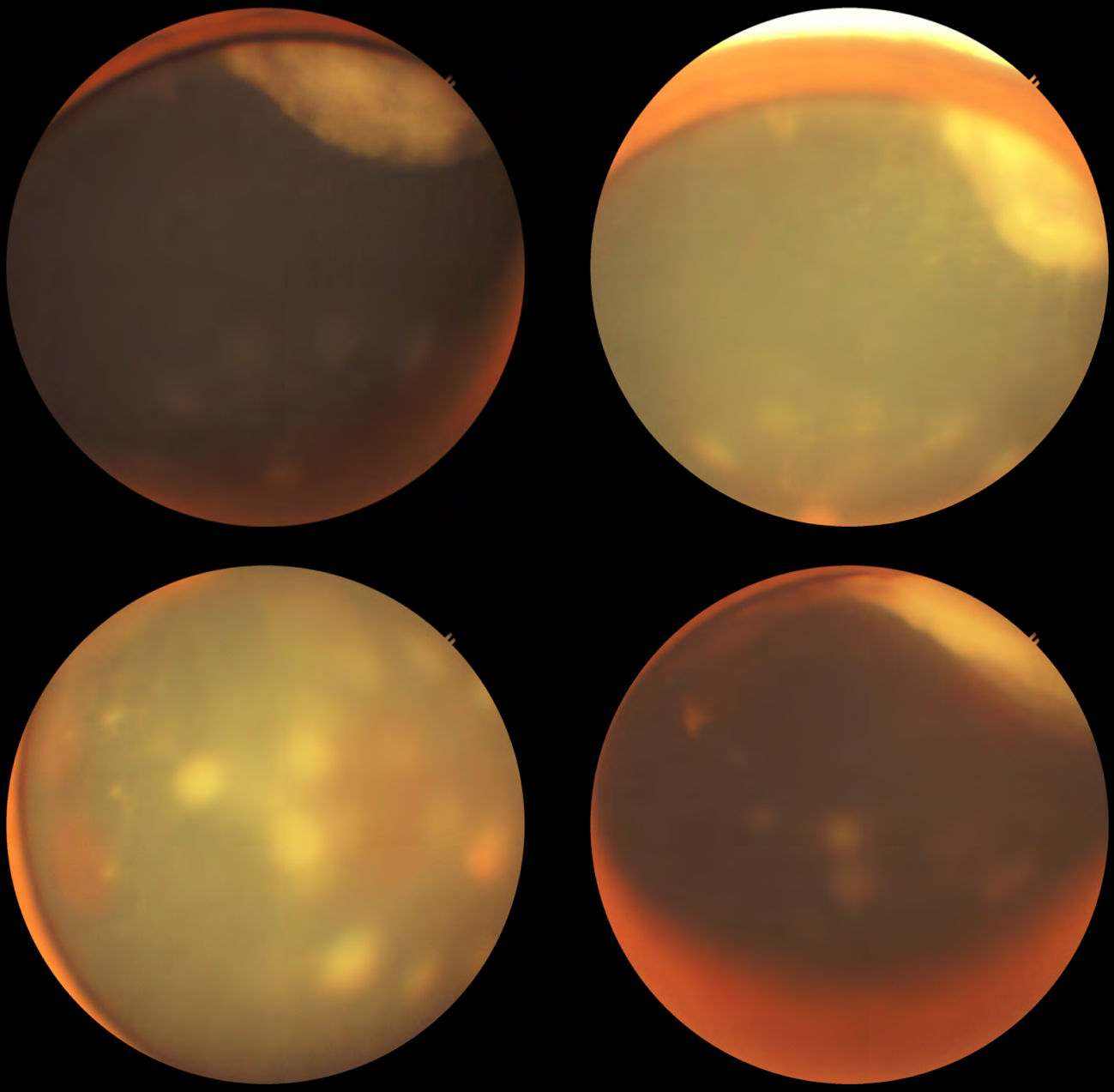


ROP stage 3 in the right eye



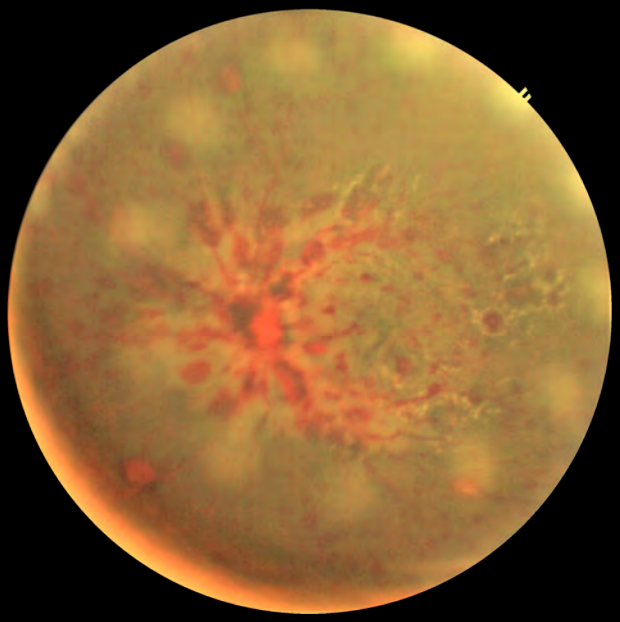
ACUTE RETINAL NECROSIS

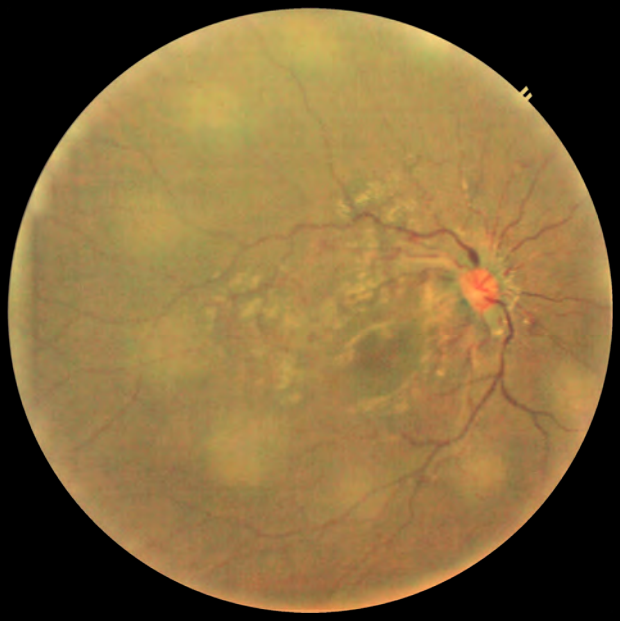
Image Credits - LV Prasad Eye Institute



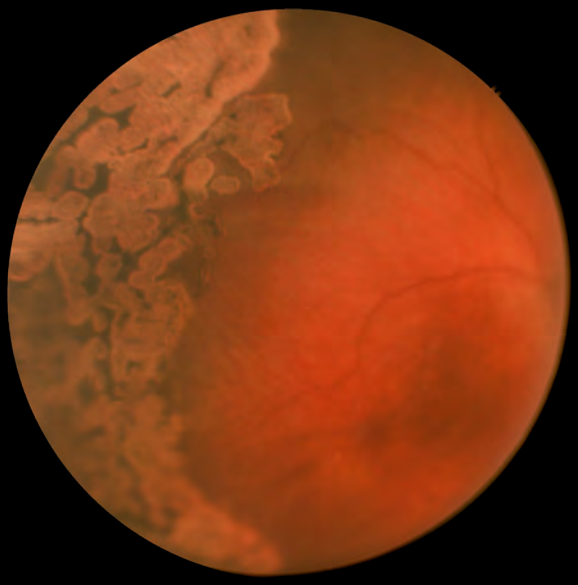
CRVO

Image Credits - LV Prasad Eye Institute

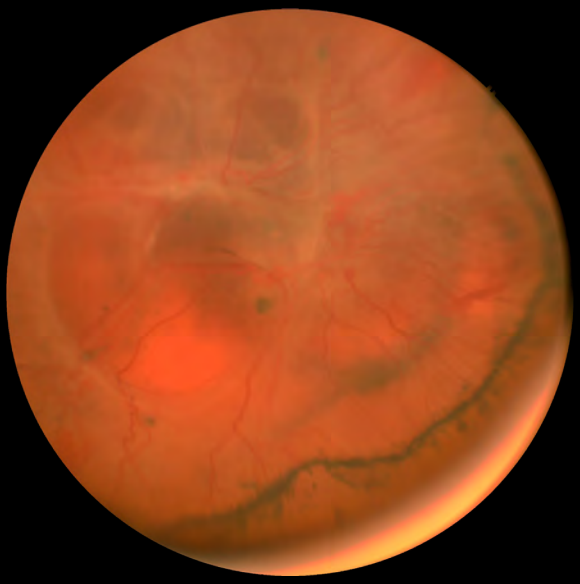




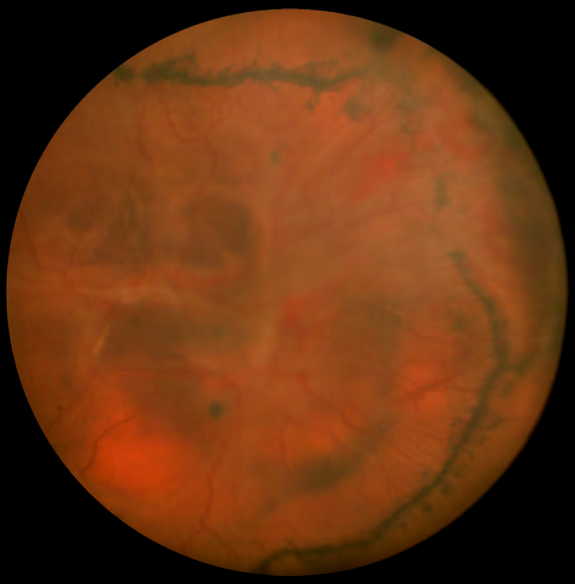
Intra-retinal Hemorrhage



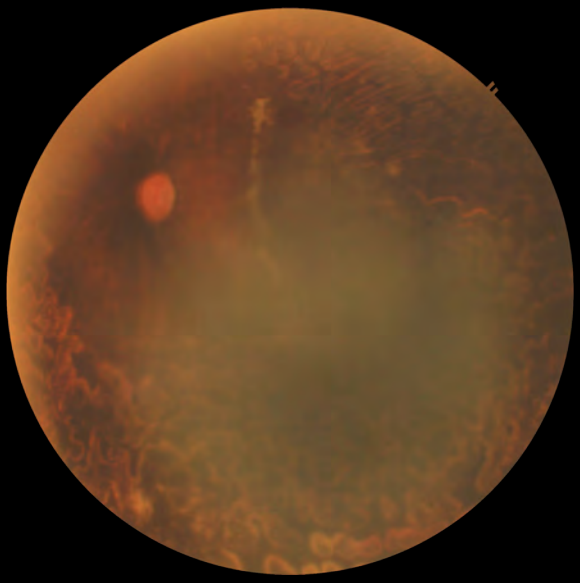
Laser Scar



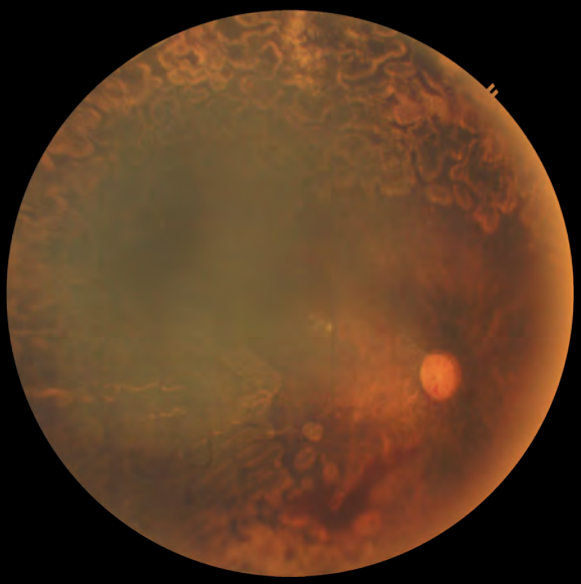
Detachment



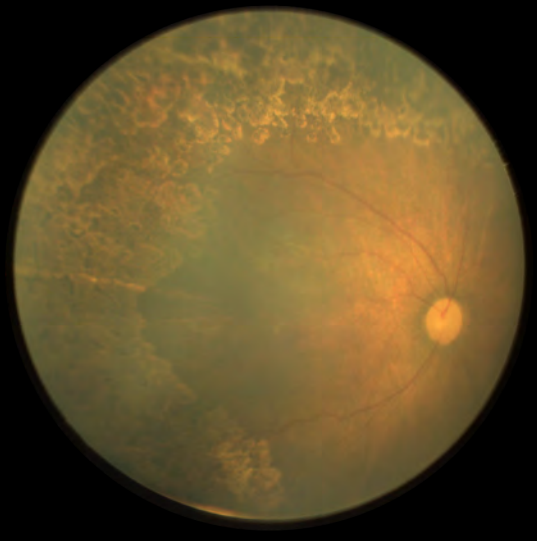
Detachment



Lasered regressed ROP LE



Lasered regressed ROP RE

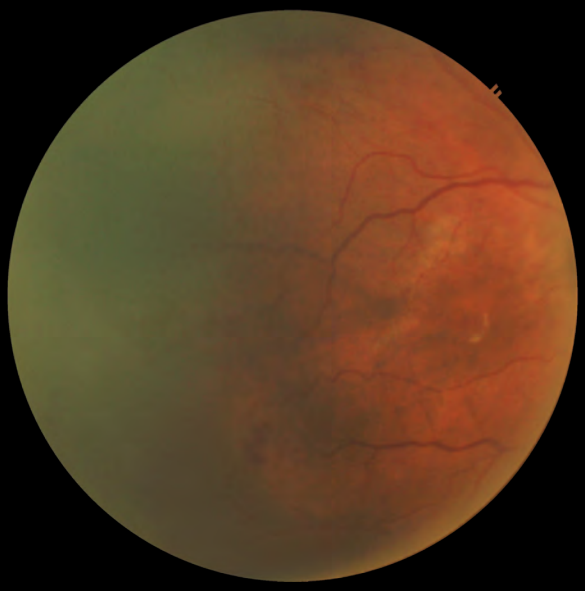


Lasered Regressing

Normal Retina

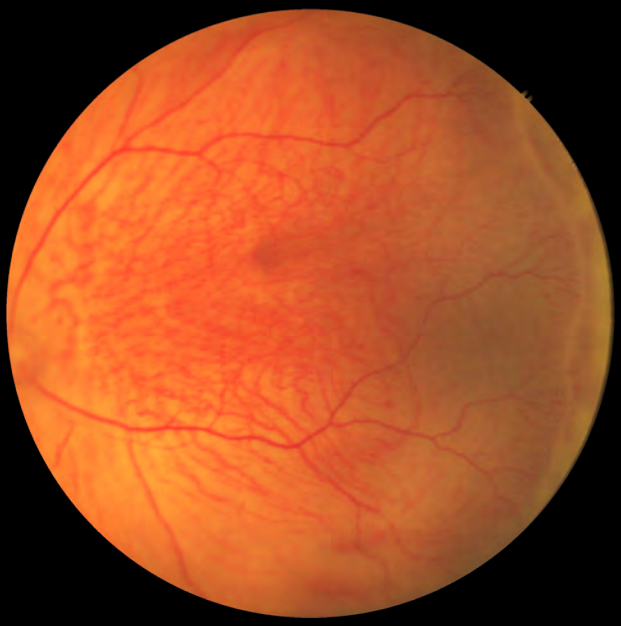
Plus Disease

Plus Disease



Plus Disease

Normal



Stage 2 - Zone 2

Stage 2-Zone2-Double ridge

FEVR - FAMILIAL EXUDATIVE VITREO RETINOPATHY

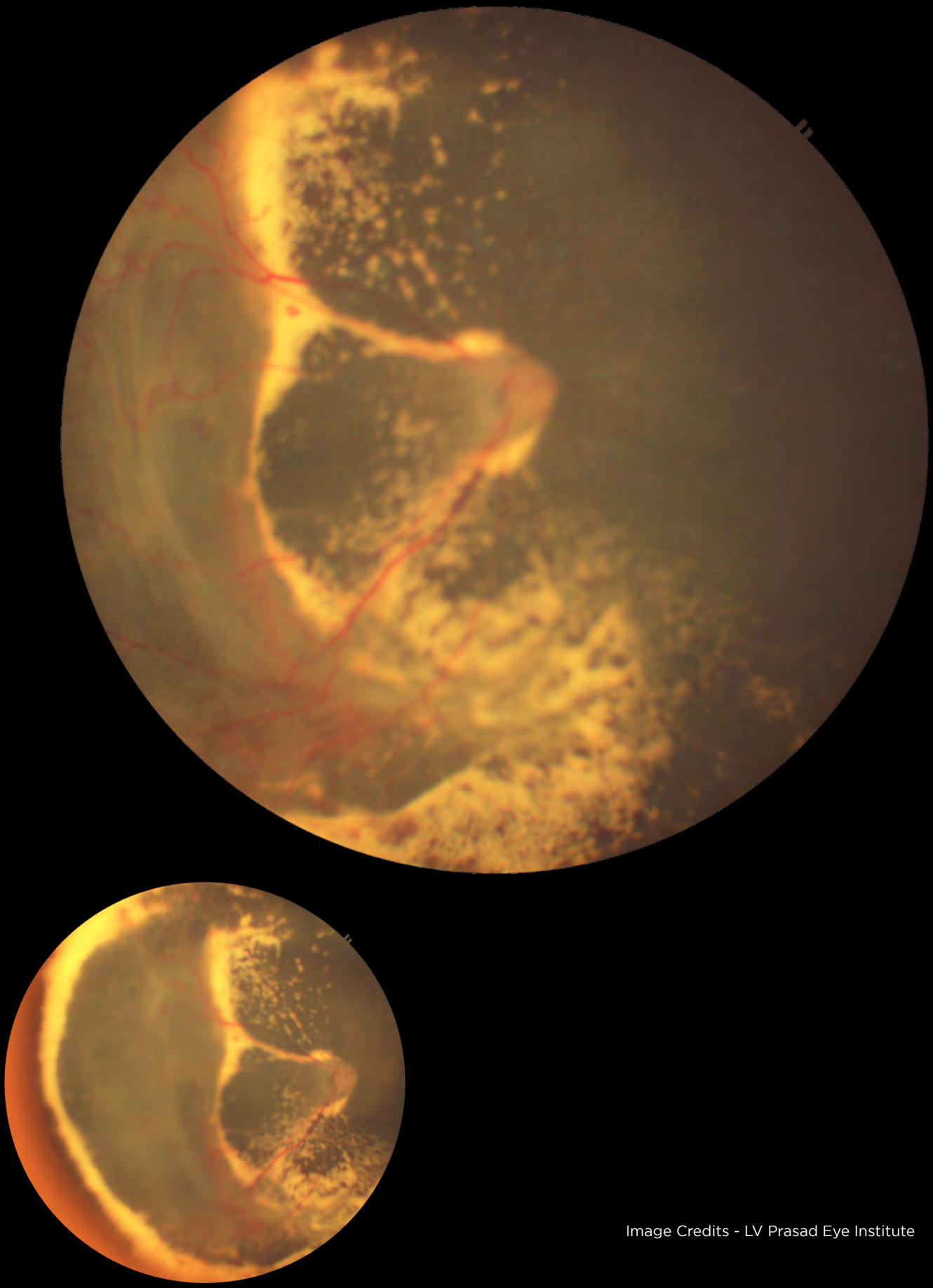
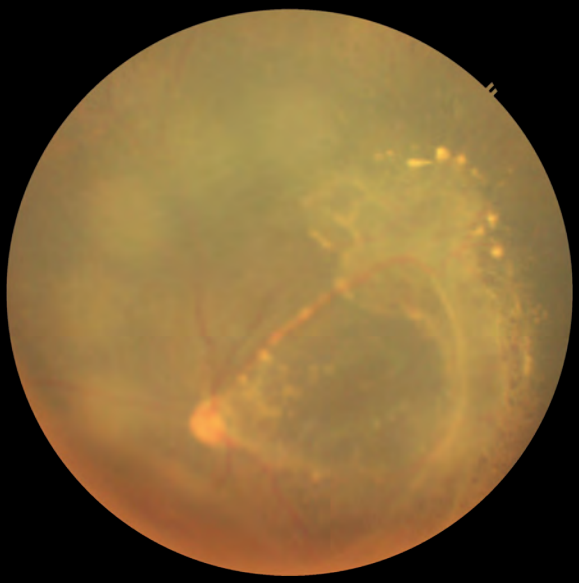
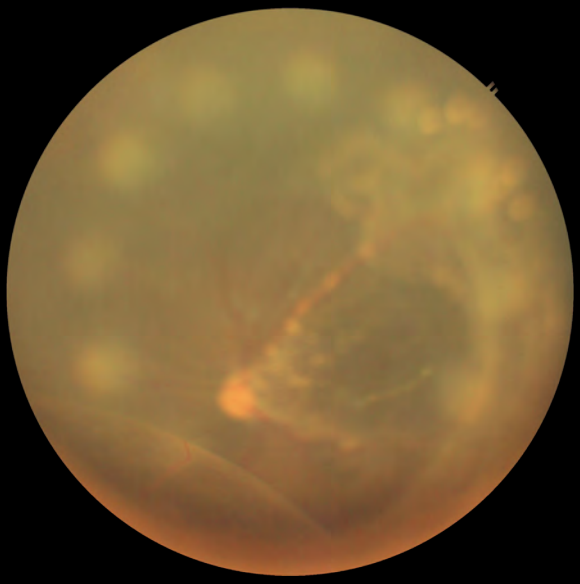
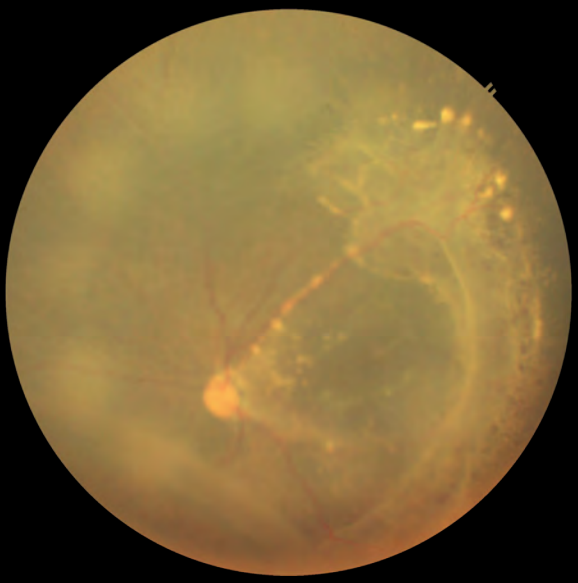
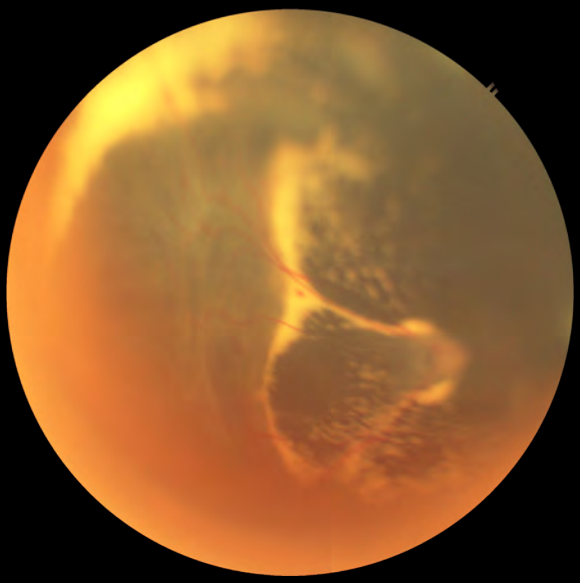
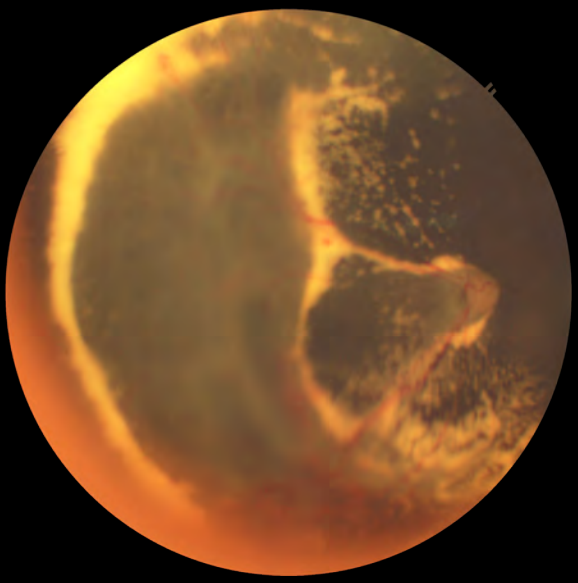


Image Credits - LV Prasad Eye Institute

MORNING GLORY SYNDROME

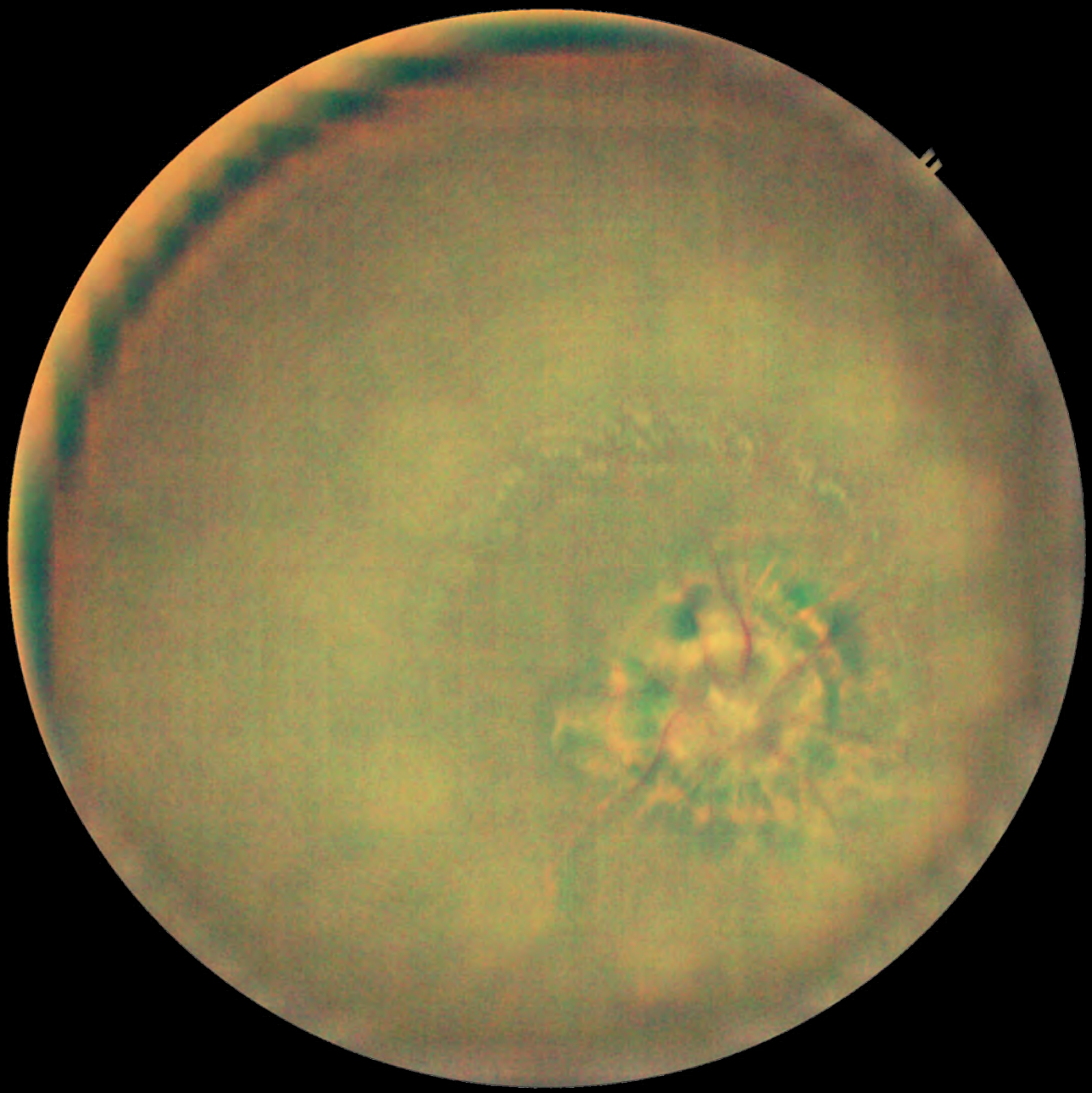
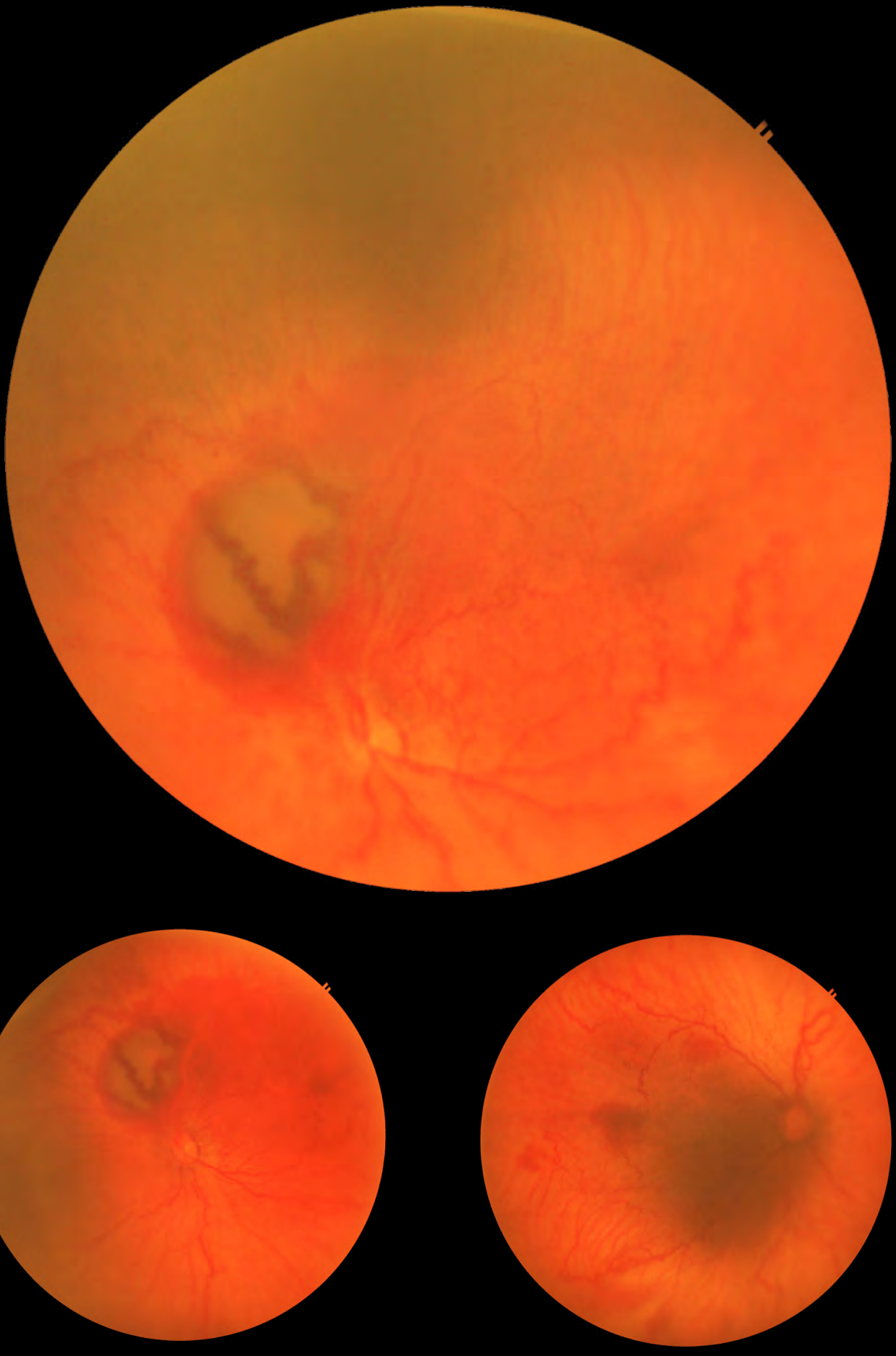
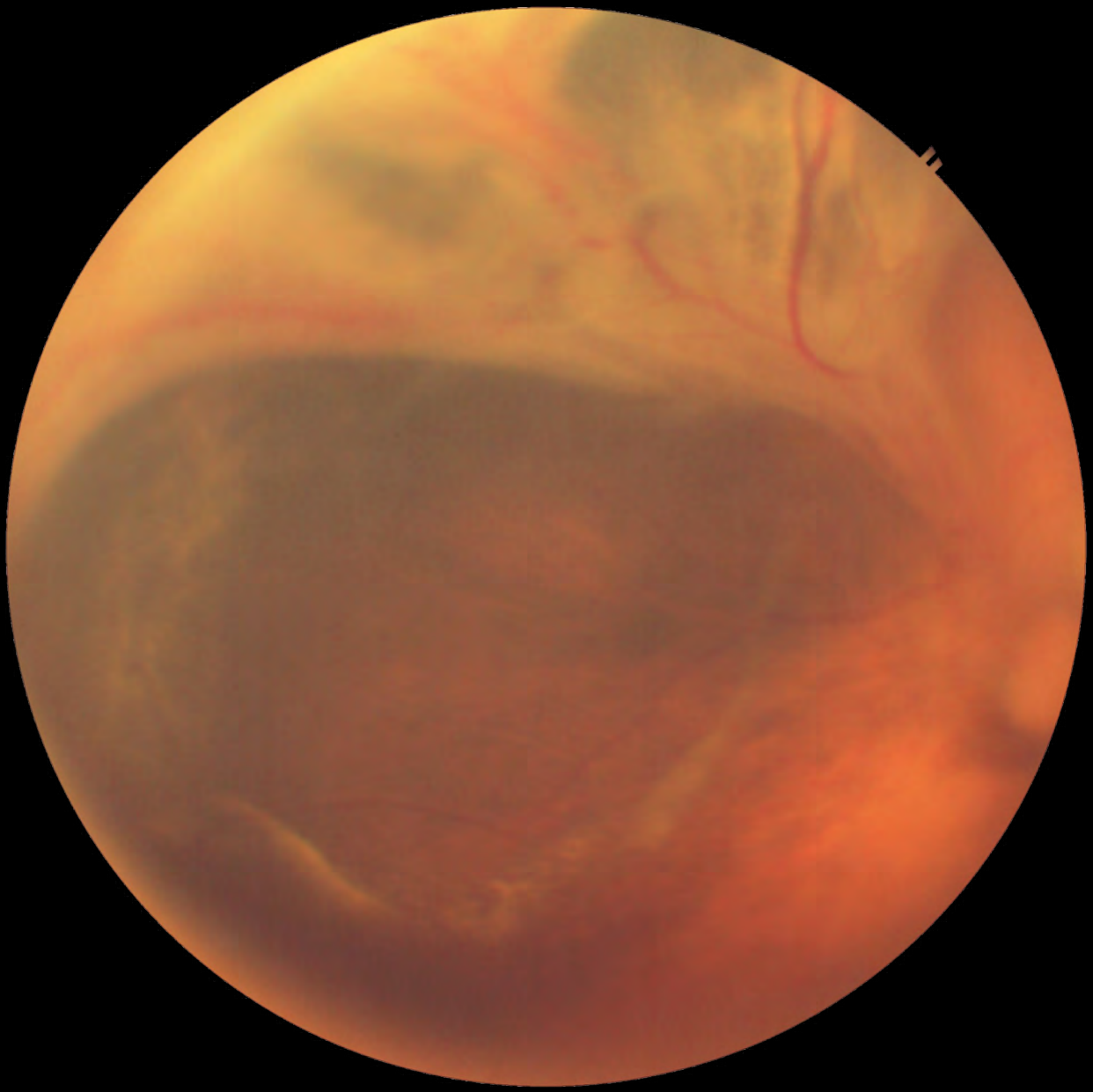


Image Credits - LV Prasad Eye Institute

LOCALISED SUBRETINAL HEME



STAGE 4A



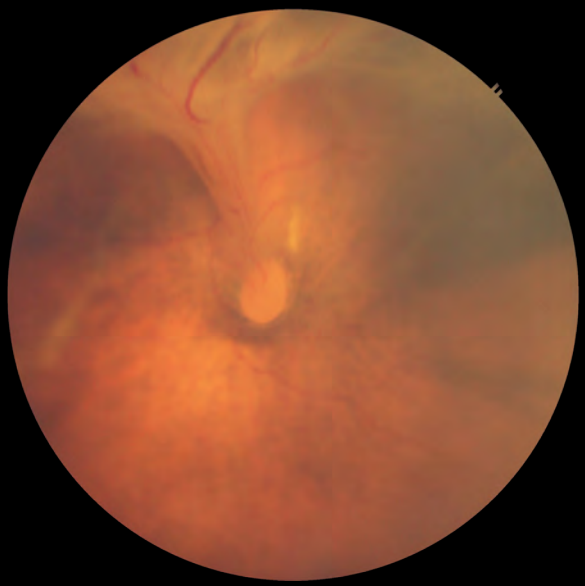
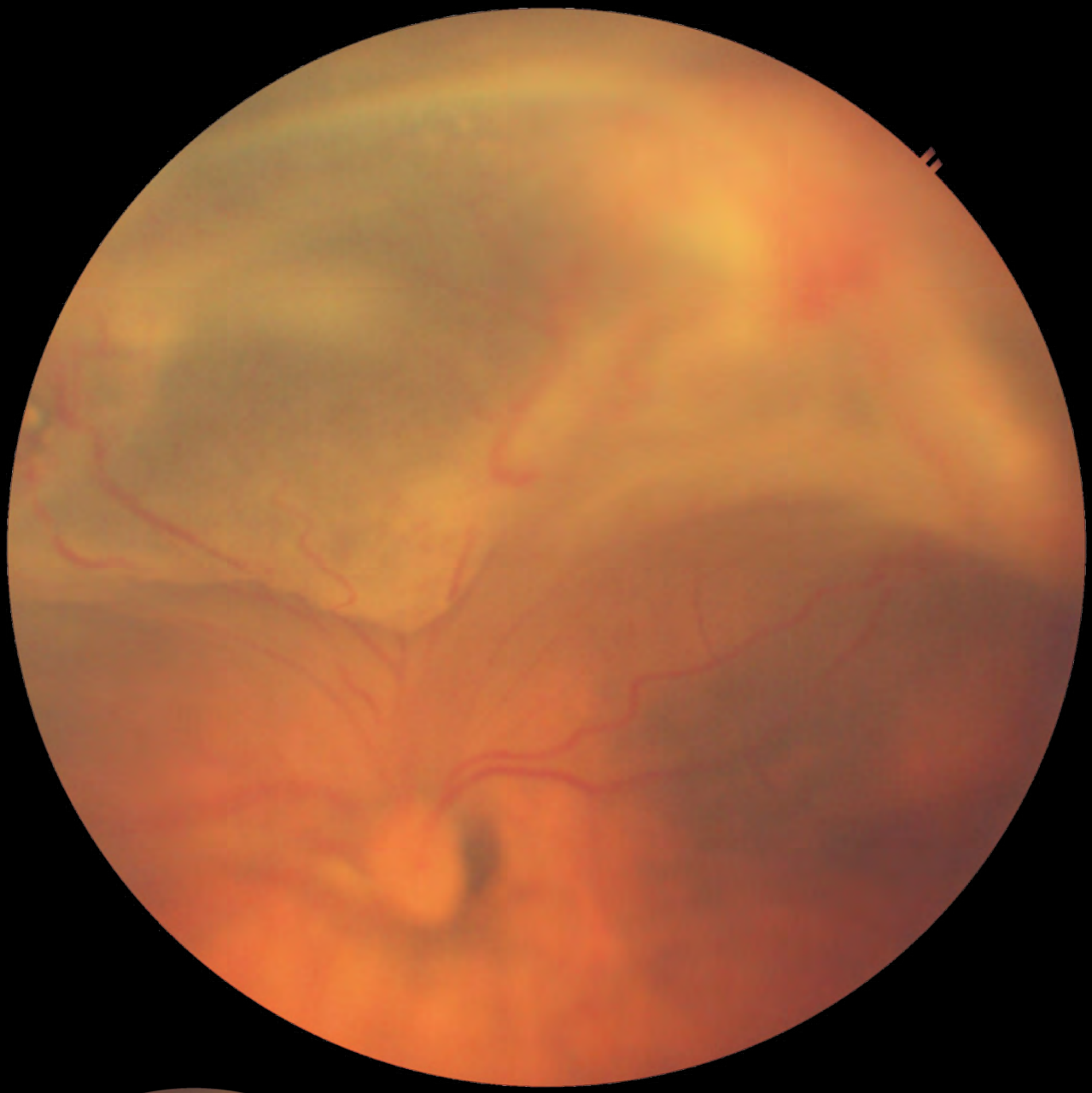
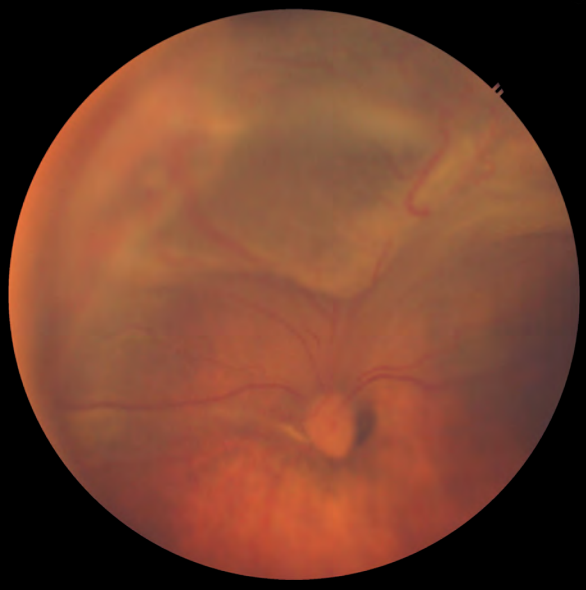


Image Credits - LV Prasad Eye Institute





SPECIAL CASES - ROP TRD

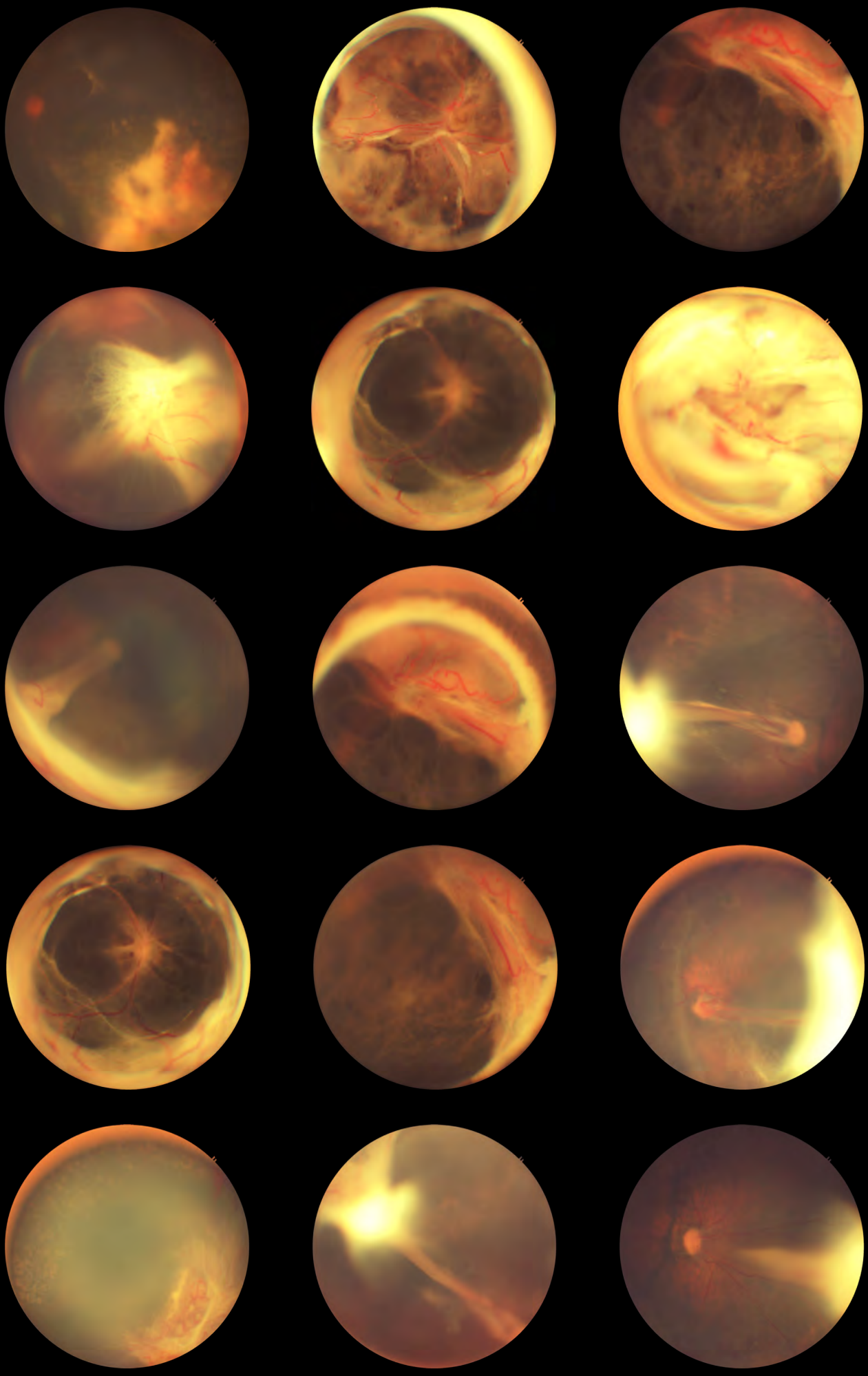
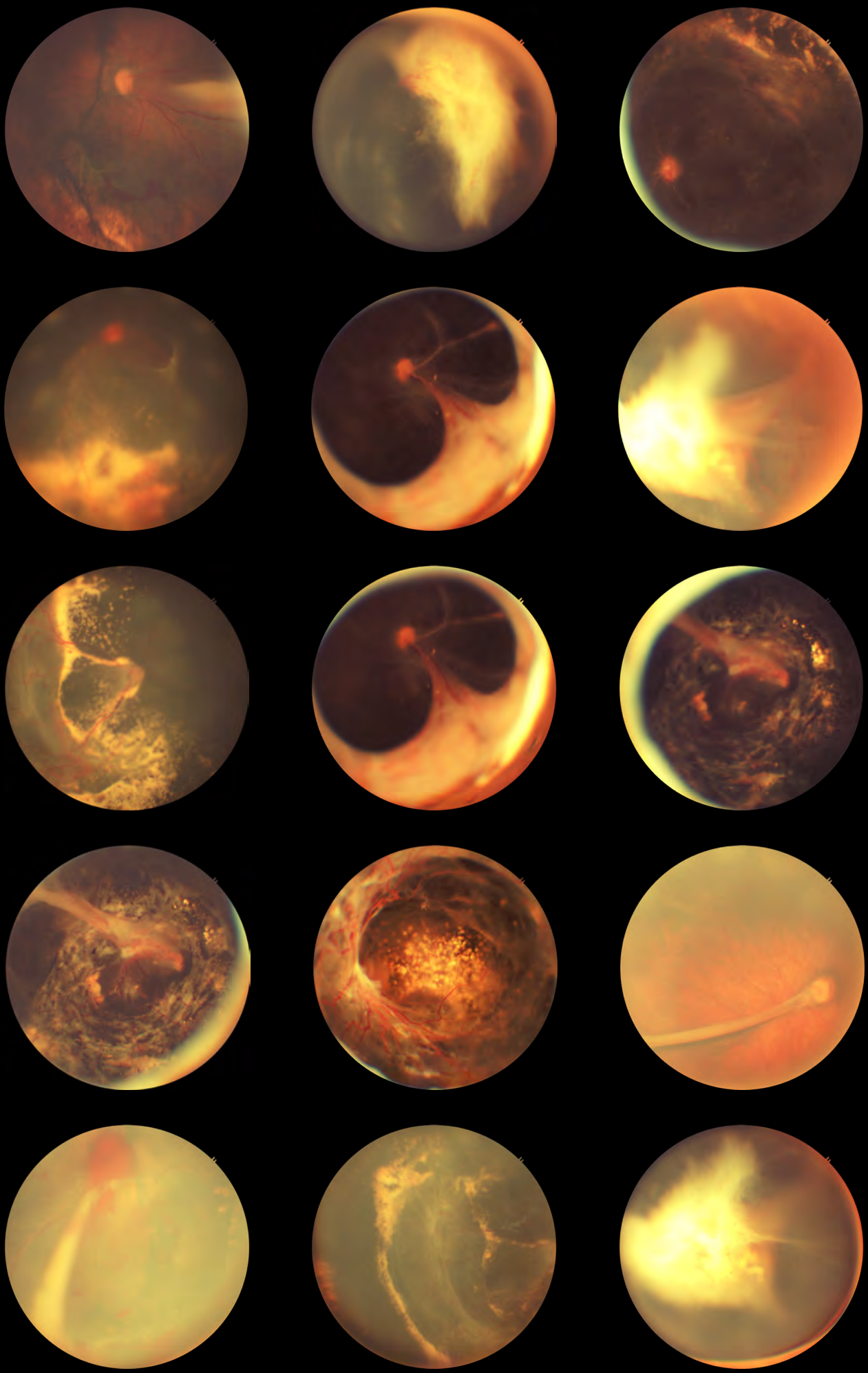
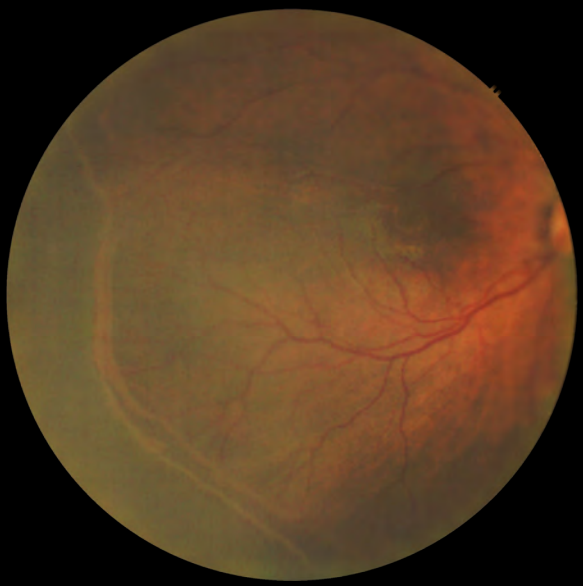


Image Credits - LV Prasad Eye Institute

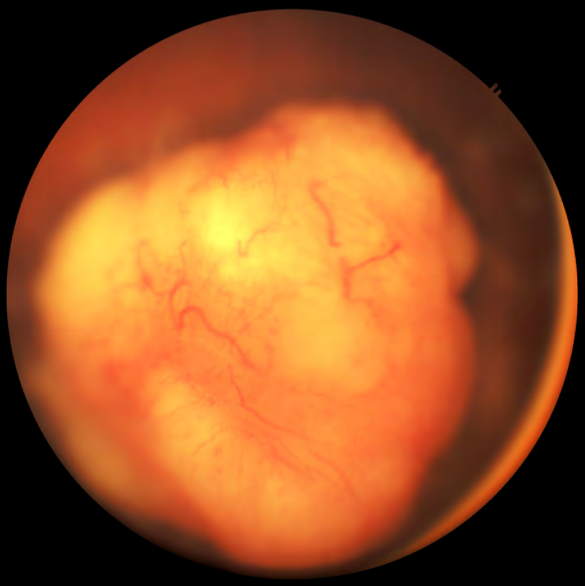


RETINA IMAGES OF INFANTS FROM EUROPEAN ETHNICITIES



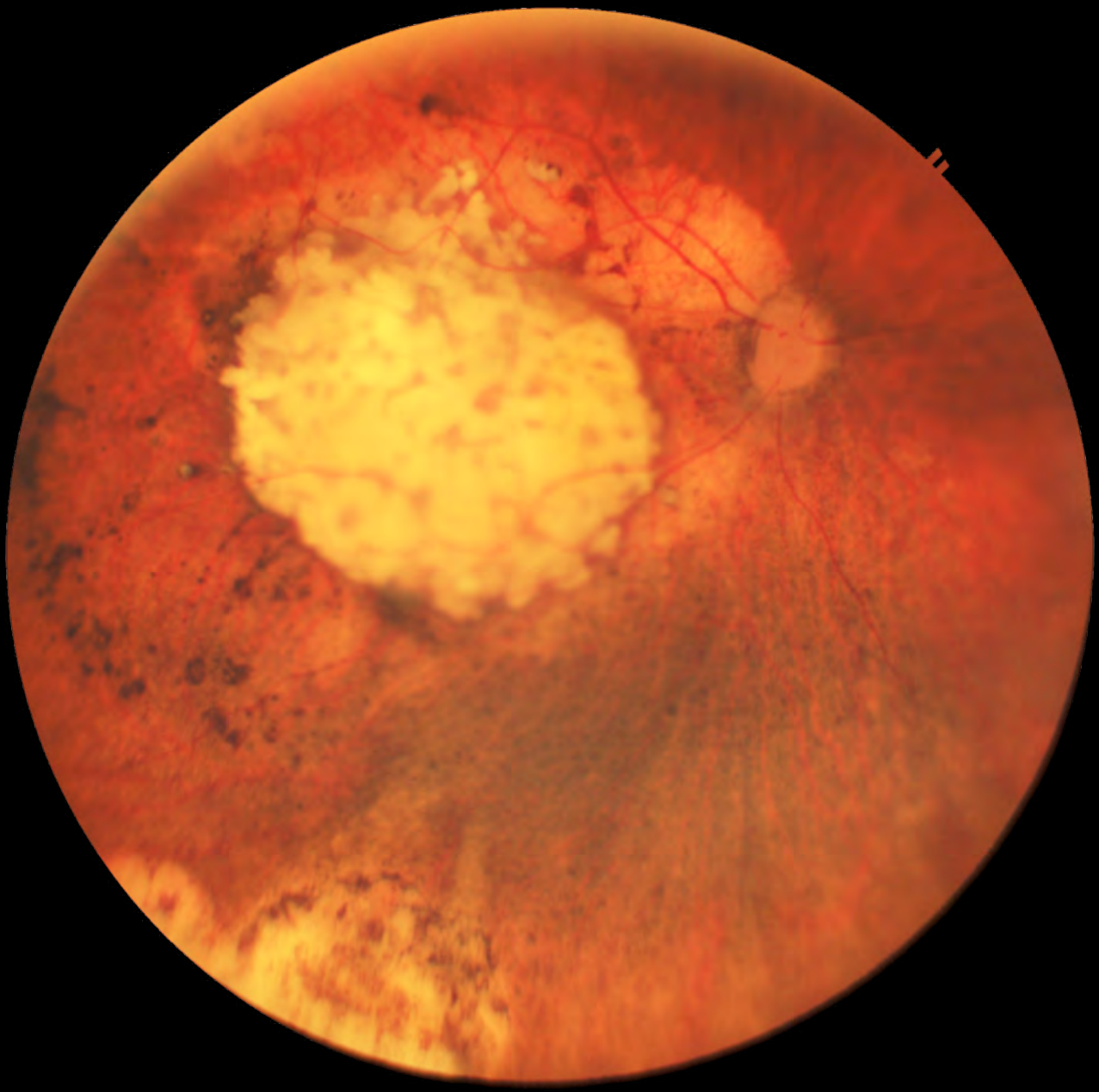
stage 2 Zone 2 Images from UK

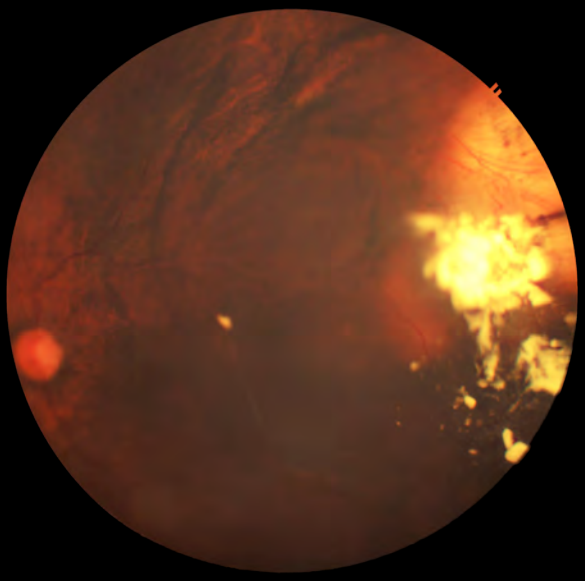
RETINA IMAGES OF INFANTS FROM EUROPEAN ETHNICITIES



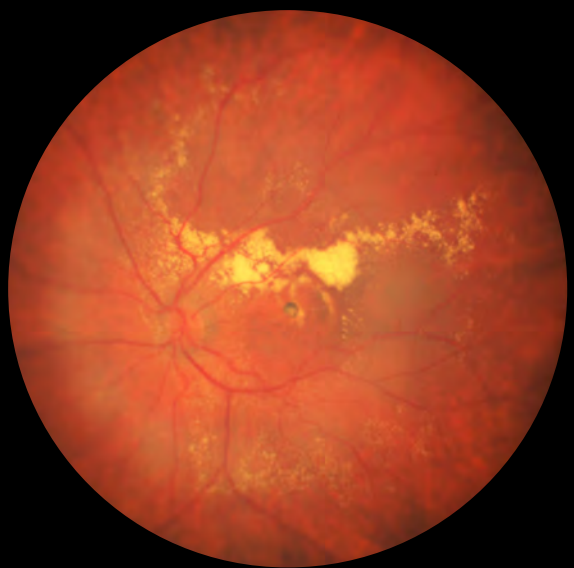
RETINOBLASTOMA

Image Credits - Hospital Sant Joan de Déu, Barcelona



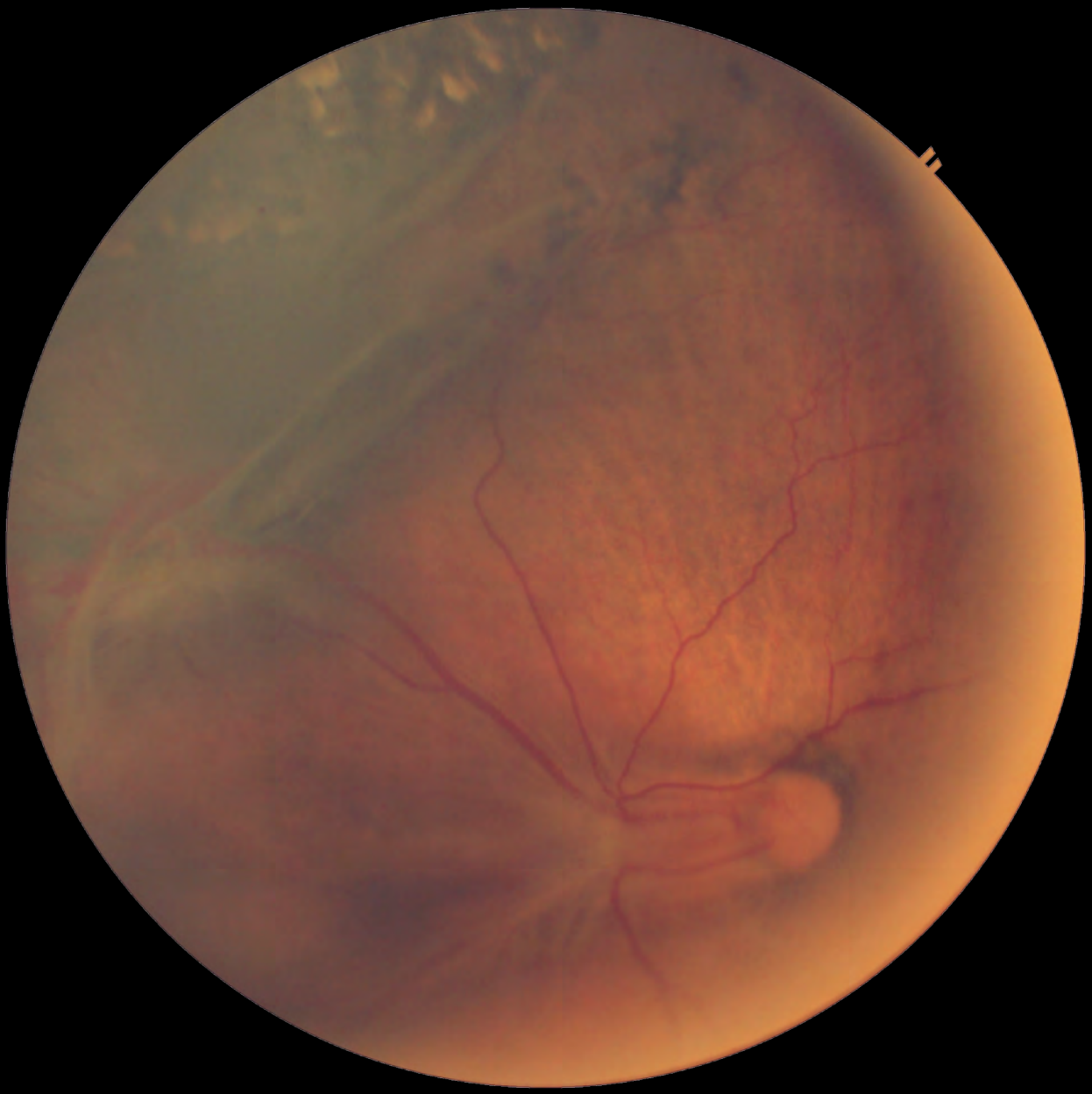


RETINA IMAGES OF INFANTS FROM EUROPEAN ETHNICITIES

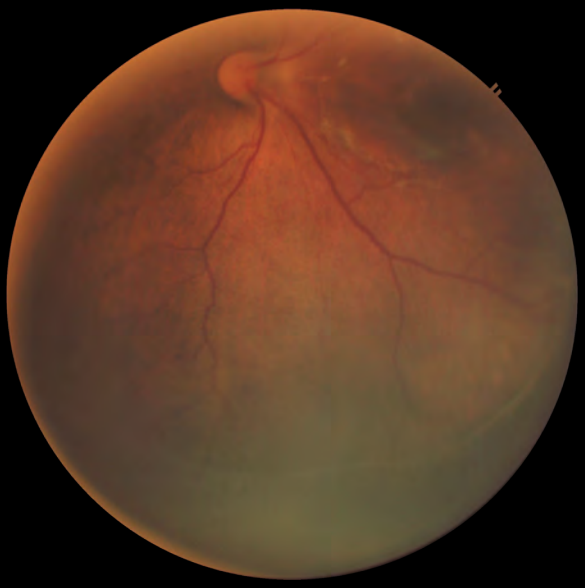


COATS Disease

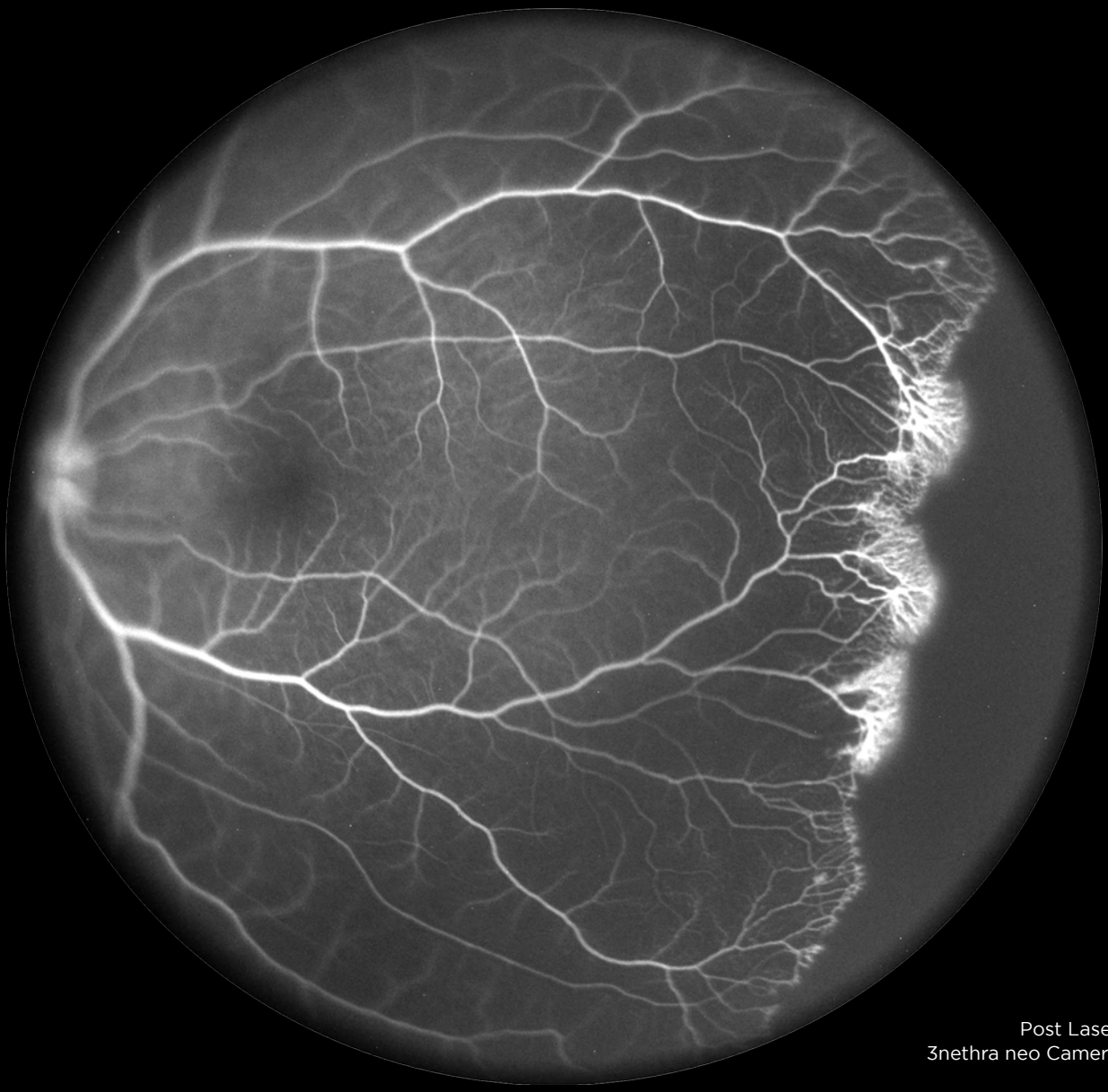
Image Credits - Hospital Sant Joan de Déu, Barcelona



Stage 4B ROP
Post Laser

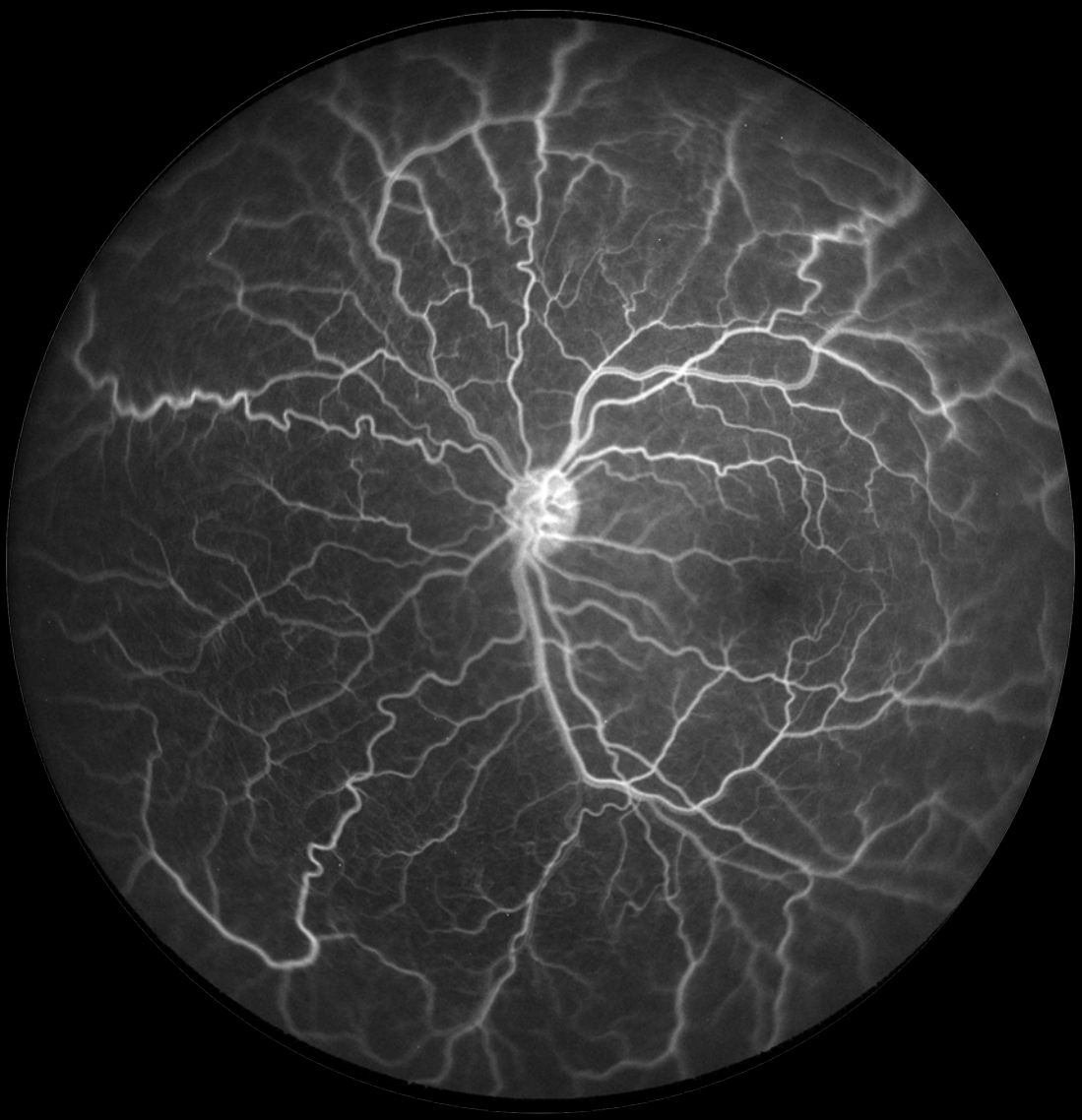


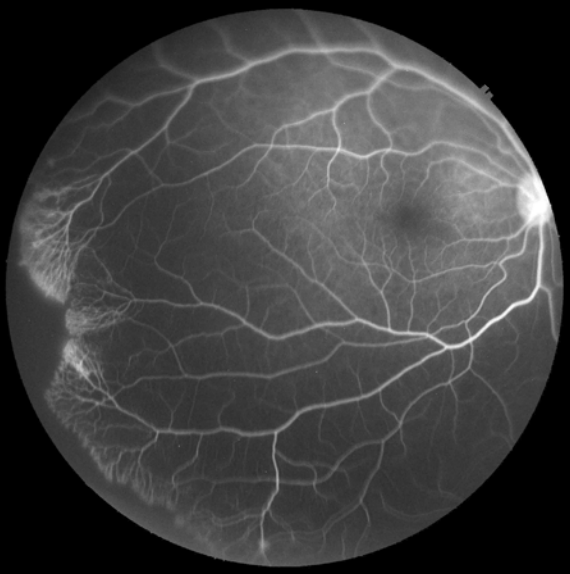
Inferior active ridge

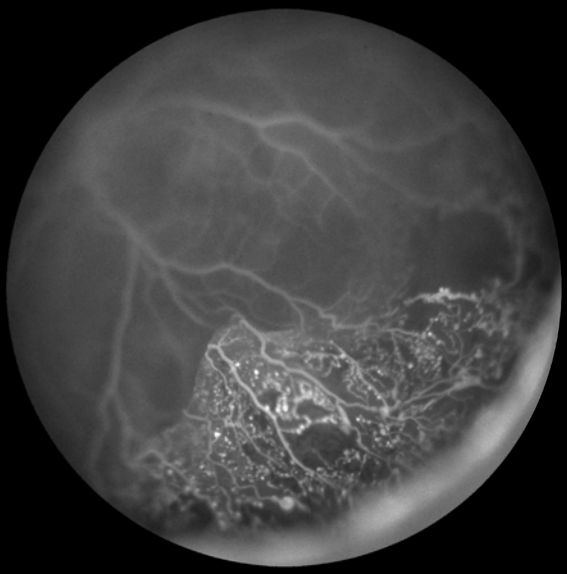


Post Laser
3nethra neo Camera

FUNDUS FLUORESCEIN ANGIOGRAPHY

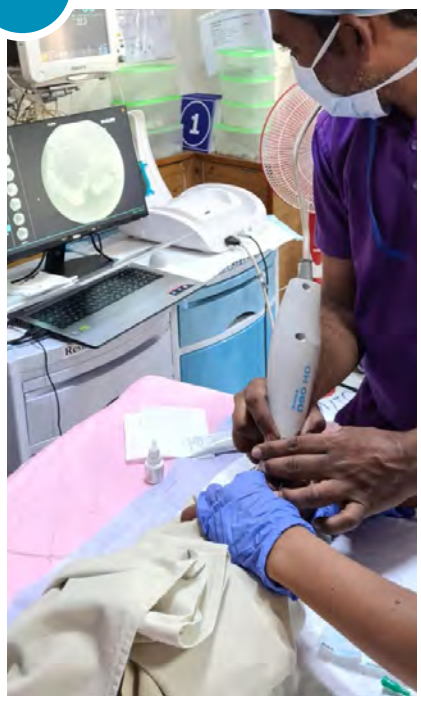






CLINICAL TRIALS

Forus Health carried out clinical trials of 3nethra neo and 3nethra neo HD FA at Narayana Nethralaya, Bangalore.



During clinical trial at Narayana Nethralaya - 3nethra neo HD FA

tvst

https://doi.org/10.1167/tvst.8.2.2

New Developments in Vision Research

A Novel, Low-Cost, Wide-Field, Infant Retinal Camera, "Neo": Technical and Safety Report for the Use on Premature Infants

Anand Vinekar[1], Shyam Vasudeva Rao[2,3], Seema Murthy[4], Chaitra Jayadev[1], Mangat R. Dogra[5], Anshuman Verma[6], and Bhujang Shetty[7]

[1] Department of Pediatric Retina, Narayana Nethralaya Eye Institute, Bangalore, India
[2] Maastricht University Education and Research Center, Bangalore, India
[3] Forus Health, Bangalore, India
[4] Public Health Consultant, Rubanbridge Pvt. Ltd., Bangalore, India
[5] Department of Ophthalmology, Advanced Eye Centre, Post Graduate Institute of Medical Education and Research (PGIMER), Chandigarh, India
[6] GROW Research Laboratory, Narayana Nethralaya Foundation, Bangalore, India
[7] Department of Ophthalmology, Narayana Nethralaya Eye Institute, Bangalore, India

Correspondence: Anand Vinekar, Department of Pediatric Retina, Narayana Nethralaya Eye Institute, Bangalore, India. e-mail: anandvinekar@yahoo.com

Received: 13 July 2017
Accepted: 17 July 2018
Published: 8 March 2019

Keywords: retinopathy of prematurity; RetCam; Neo; wide field imaging; low cost

Citation: Vinekar A, Rao SV, Murthy S, Jayadev C, Dogra MR, Verma A, Shetty, B. A novel, low-cost, wide-field, infant retinal camera, "Neo": technical and safety report for the use on premature infants. Trans Vis Sci Tech. 2019;8(2):2, https://doi.org/10.1167/tvst.8.2.2

Purpose: To report the technical aspects, systemic, and ocular safety of a novel, low-cost, wide-field, infant retinal camera for use on premature infants.

Methods: The device, the "3nethra Neo" (Neo) is a 120° portable, contact, wide-field, unibody camera, with a CMOS sensor (2040 × 2040 resolution) and a warm light-emitting diode (LED) illumination source. The Neo was used to image 140 awake, preterm infants between postmenstrual age (PMA) of 28 to 37 weeks, undergoing retinopathy of prematurity (ROP) screening. Baseline, 'during procedure', at 5 minutes, and for 60 minutes postprocedure, readings of oxygen saturation and heart rate were recorded. The device design, optics, illumination, and software specifications were compared with the RetCam 3.

Results: Study defined bradycardia (9 infants, 6.4%), tachycardia (3 infants, 2.1%), and hypoxia (2 infants, 1.4%) were observed but there were no clinically significant systemic changes that required intervention during or following any of the study time intervals. There was a transient increase in heart rate by 9.68 (7.53–11.83; $P < 0.0001$) and marginal decrease in oxygen saturation (−1.94 [−1.60 to −2.28], $P < 0.0001$), which started to return to baseline 5 minutes after the procedure. Transient redness was seen in two eyes (0.7%) of two infants. No other ocular adverse effects were observed.

Conclusions: The Neo is easy to use in preterm infants and being compact was readily portable. There were no significant ocular or systemic adverse effects, potentially allowing it to be a viable low-cost device for ROP screening in low resource settings.

Translational Relevance: The camera provides a safe and affordable alternative to image the retina of infants by using novel illumination and lens mechanics and has the potential of worldwide acceptance.

Introduction

Every year, 15 million babies are born premature globally, with India and China collectively contributing to a third of that number.[1] With improving neonatal care, survival of these infants is increasing, and with it, the burden of retinopathy of prematurity (ROP) management. In India, with a greater proportion of these premature deliveries occurring in the remote and rural areas, the unmet challenge of unscreened ROP has added to the burden of

preventable childhood blindness.[2] The situation is similar in many of the middle-income countries in Asia, Eastern Europe, and Latin America, leading to the global 'third epidemic' of this disease.[3,4]

In India, the awareness about ROP has recently increased. A recent judgment by the Supreme Court of India against a government managed, tertiary-care hospital for failing to provide a female child timely ROP screening awarded the family a compensation of USD 300,000.[5] This landmark judgment ruled that ROP screening is 'standard of care' and part of the 'essential services' to be provided to 'at risk' premature infants. Unfortunately, currently, neither the private nor the public health care delivery systems are capable of handling the burden of screening.[6,7] With over 3.5 million infants born premature annually,[1] and less than 100 ROP specialists across the nation, screening for ROP is an important unmet public health challenge.[8]

The traditional gold standard of ROP screening using the binocular indirect ophthalmoscope has been challenged even in the West.[9] In countries like India, the lack ROP specialists makes this even more unfeasible. Since 2008, wide-field imaging by trained and accredited nonphysicians who use a telemedicine platform has been developed, validated, and reported from India.[8,10–12] An Australian report evaluating the Indian tele-ROP model based on the Centers for Disease Control (CDC) guidelines, observed that any 'deviation from the wide-field imaging and photo-documentation model could be fraught with the danger of suboptimal care'.[13] This has resulted in the Government of India accepting wide-field imaging as a viable and practical alternative method for screening for ROP in the rural and district special neonatal care units and has invited innovations of cost-effective devices and solutions to fill this gap. Despite the successful deployment of the RetCam Shuttle (Clarity MSI, Pleasanton, CA, USA) in the rural program of Karnataka Internet Assisted Diagnosis of Retinopathy of Prematurity (KIDROP) and some other states, the cost of the device and the technology has prevented the scaling up of the National ROP Program, which is imperative in the current scenario.

This study reports a new, wide-field infant retinal camera primarily developed for ROP screening. This device, the "3nethra Neo" (Neo), invented by Forus Health, Bangalore, India was evaluated for its systemic and ocular safety for the use on premature infants. The device has also been compared with the RetCam 3 in a multicenter prospective study, which will be reported subsequently.[14]

Methods

This is a clinical, observational, hospital-based study describing the safety of a new retinal imaging device while using it on infants undergoing ROP screening.

'Neo' Specifications

The Neo was developed in India by Forus Health, a technology-led company focused on ophthalmic care. The research and development for the device was initiated in 2012 and evolved through four prototypes with inputs from ROP specialists. Significant enhancements through the prototypes included the replacement of the illumination source from an optical fiber to a light-guided light-emitting diode (LED) illumination system and from a motorized focusing component to a liquid-lens focusing system in the current study version. The weight of the hand piece was reduced during each version and currently weighs 310 grams. The device, cables, foot switch, and accessories are placed in a single portable suitcase (Fig. 1). The design, optics, illumination, and software specifications are summarized in Table 1 and are compared with the RetCam 3 (Clarity MSI). Data about the Neo was provided by the device manufacturer.

The device was used for a safety assessment study at our institute. This study fulfilled the requirements of the hospital safety committee and the clinical research department and adhered to the tenets of the Declaration of Helsinki and was accepted by the Institute Research Board and the Institute Ethics Committee after the manufacturer provided a device safety compliance report for electrical and light safety. The device was tested initially on healthy, adult volunteers before being used in this study on infants.

Study Cohort

The study cohort comprised of consecutive Asian Indian premature infants enrolled for ROP screening under the KIDROP program. All study infants were less than 2000 g and/or 34-weeks gestational age or less and were less than 30 days of life when first screened, as per the national guidelines.[15] The program screens in 104 neonatal intensive care units, but for the purpose of this study, only infants

Figure 1. The Neo device with the cables, foot switch, and accessories placed in a single portable suitcase.

Table 1. Technical Comparisons Between the Novel Infant Retinal Camera 'Neo' and the Most Commonly Used Camera (Gold Standard) "RetCam"

	Neo	RetCam
Design		
Probe design	Single, monolithic hand-held probe	Detachable front optical hand-held probe
Weight (with lens and wire)	740 g	800 g (measured manually)
Image capture	Video and still	Video and still
Image size	300 KB–9 MB	150 KB–1.6 MB
Image resolution	2040 × 2040	1600 × 1800
Image shape	Square, complete circular image	Rectangle, cropped image
Optics		
Field of view	Maximum 120° field of view	Maximum 130° field of view with additional attachment lens
Focus	Noiseless, motionless focus mechanism using liquid lens	Motorized focus
Image capture	Foot pedal and on screen	Foot pedal and on keyboard
Illumination		
Light source	LEDs with waveguide optics	Halogen with optical fibers
Position of light source	Internal	External
Intensity of light source	100–6000 lux	100–6000 lux
Wavelength	Warm LED	Halogen light
Software and service		
Live zoom	Available	Not available
Telemedicine integration	Neocare	RetCam Review Software

Table 2. Study Definitions of Systemic Factors

Bradycardia	Heart rate <80 bpm sustained for >30 sec[16]	
Tachycardia	Heart rate >200 bpm sustained for >30 sec[16]	
Hypoxia	Oxygen saturation <80% sustained for at least 30 sec[16]	Drop in oxygen saturation ≥20% of baseline[17,18]
Apnea of prematurity	Breathing pause lasting for 10 sec[16]	
Others	Cyanosis, vomiting, seizure activity	

screened at Bangalore were enrolled to allow better monitoring of the systemic and ocular parameters. Parents or legal guardians accompanying the infant were counseled and an informed consent was obtained from all cases. Wide-field imaging performed by a trained and certified imager is the screening method of choice in the KIDROP program. This differs from indirect ophthalmoscopy performed by an ophthalmologist in that imaging is performed by a contact camera, which is placed over the cornea of the infant's eye using a coupling agent (Lubic Gel; Neon Pharma, Mumbai, India. Additional material on the safety and experience of this coupling agent can be found in Supplementary File S1). The eye is pried open using an infant wire speculum. Eyes are imaged one at a time. With indirect ophthalmoscopy, the ophthalmologist also uses a speculum to pry open one eye at a time. In addition, a Flynn infant speculum is used to visualize each quadrant using a 20-diopter (D) double aspheric lens. The method is subjective and cannot be recorded as images. The process of wide-field imaging has been reported in several reports of our group. Over 100,000 sessions have been completed in the past decade.[6–8,10–13]

Only the first ROP screening session was included in this analysis. Infants were monitored by an anesthetist and a pediatric nurse throughout the study session. Pupillary dilatation was started 1 hour prior to the imaging session and was achieved with a commercially available combination of phenylephrine 2.5% and cyclopentolate 0.5% (Auropent Plus; AuroLab, Tamil Nadu, India) one drop in each eye, repeated two to three times, 10 minutes apart. Babies were not fed an hour before and until an hour after the imaging session.

Ocular adverse outcomes that were looked for included conjunctival hemorrhage, laceration, corneal abrasion, ocular infection, hyphema, and retinal or vitreous hemorrhages. Systemic adverse effects that were looked for included bradycardia, tachycardia, hypoxia, apnea, cyanosis, seizure, and vomiting. Any other abnormal behavior was also documented, if present. The study definitions for the systemic adverse events were as per previously published criteria and are summarized in Table 2.

Readings of oxygen saturation and heart rate were recorded using a portable multiparameter infant monitor (Mindray, VS-800 NIBP; Absolute Medical Services Inc, Stony Point, NY) for 60 minutes before the start of procedure with the last reading considered as baseline, 'during the procedure', 5 minutes after, and for 60 minutes after procedure, with the last reading recorded as the reading at 60 minutes postprocedure. Heart rate was monitored continuously though the period and any episode above or below cut off was monitored to see if it lasted for greater than 30 seconds to record it as an 'episode'. Similarly, oxygen was monitored to see if it fell below 80% saturation and if it lasted for 30 seconds or more was labelled an 'episode' of hypoxia. As per the other study definition of hypoxia, any reading 20% or less of baseline was counted as an 'event'. Because it was difficult to monitor oxygen saturation during the procedure, we had readings in less than 50% of babies and hence not included for analysis. For analysis therefore, recordings 1 hour before the procedure, immediately after the procedure, and an hour after the procedure were used for outcome analysis.

Ocular adverse effects were noted during, immediately after the imaging and at the end of 1 hour by the ROP specialist. The anterior segment was examined with the magnification of the 20-D lens and the retina using indirect ophthalmoscopy. The baby was monitored by the parents and a nursing staff prior to discharge. The caregivers were asked to report any adverse effects even if they did not attribute it to the eye imaging, and included eye discharge, redness, watering, or stickiness. Information of systemic and ocular adverse effects were collected doing a chart

Table 3. Mean Differences Between Two Time Points of Examination

Measure and Test	Time	Mean	Mean Difference (CI) From Baseline
Heart rate[a]	Baseline	147.03	
	During	156.71	9.68 (7.53–11.83)*
	5 min after procedure	150.23	3.20 (1.75–4.65)*
	60 min after procedure	148.07	1.04 (2.33 to −0.24)
Oxygen saturation[b]	Baseline	94.54	
	During	92.59	−1.94 (−1.60 to −2.28)*
	5 min after procedure	93.35	−1.19 (−0.90 to −1.47)*
	60 min after procedure	94.34	−0.19 (−0.00 to −0.38)

[a] Paired *t*-test.
[b] Wilcoxon signed-rank test.
* $P < 0.05$.

review for admitted cases and phone-in for discharged babies after 24 hours.

Imaging With the Neo

Imaging with the Neo was performed after pupillary dilatation was confirmed by the ROP specialist. Topical anesthesia was achieved by proparacaine hydrochloride 0.5% (Paracain, Sunways, India). An infant wire speculum was used on one eye at a time. Imaging was performed by one of two senior ROP imaging specialists (level 3 technicians).[10] Scleral depressor was not used during the imaging in this study.

Sample Size and Statistical Analysis

Descriptive analysis was performed for means of continuous variables and proportion for categoric variables. Paired *t*-tests were used to compare mean heart rates between any two points of time. Oxygen saturation being not normally distributed, was tested with Wilcoxon signed-rank test. McNemar's test with the Yates continuity correction of 0.5, was used to compare number of events of bradycardia, tachycardia hypoxia, and apnea 1 hour before and 1 hour after the procedure. A sample size of 133 neonates was required to detect an effect size of 31%[16] in heart rate at end of 1 hour, with 90% power and a two-sided alpha error of 5%, allowing provision for a nonresponse rate of 20%. Vassarstats[16] was used for analysis and GPower[17] for sample size calculation.

Results

Of the 140 infants in the study, 86 (61.43%) were male and 54 (38.57%) were female. The mean birth weight of the cohort was 1368 (SD 289.2) g (range, 650–2026 g) and mean gestational age was 30.61 (SD 2.44) weeks (range, 26–35 weeks). The mean postmenstrual age (PMA) at which the imaging was performed was 39.74 (SD 4.75) weeks (range, 30–52 weeks).

Systemic Safety

The mean baseline heart rate was 147.03 (SD 21.13) and range of 115 (80–195) beats per minute (bpm) and the mean baseline oxygen saturation was 94.54 ± 4.42% and range 20 (80–100). During the procedure, there was a mean increase in the heart rate (156.71 [SD 23.68], range of 115 [5–200]; paired *t*-test, $P < 0.0001$), which started reducing at the end of 5 minutes (150.23 [SD 20.38], range 105 [93–198]; paired *t*-test, $P < 0.0001$) following the procedure and came back to baseline (148.07 [SD 19.28], range 103 [90–193]; paired *t*-test, $P = 0.11$) at the 60-minute recording.

The oxygen saturation decreased marginally during the procedure (92.59 [SD 5.31], range 25 [75 –100]; Wilcoxon signed-rank test $P < 0.0001$), recovered after 5 minutes (93.35 [SD 4.63], range 21 [79–100], $P < .0001$), and returned to the baseline (94.34 [SD 4.23], range 20 [80–100]; $P = 0.054$), at the end of the 60-minute period. The difference between the study points is summarized in Table 3.

The number of episodes of bradycardia, as defined by a drop-in heart rate less than 80, during the procedure was 9 (6.4%). The number of episodes of tachycardia (heart rate >200 bpm sustained for >30 seconds) during the procedure was 3 (2.14%). Number of episodes of bradycardia an hour prior to the procedure (3, 2.14%) compared with an hour after (5, 3.6%) showed no difference (McNemar's paired *t*-test

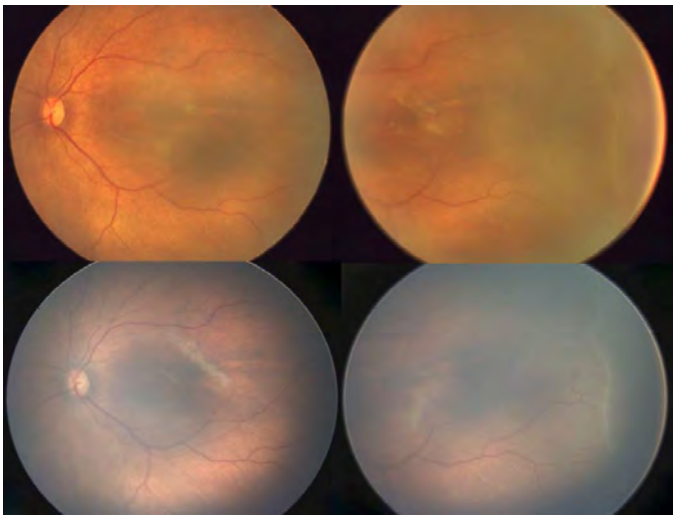


Figure 2. An infant born at 32-weeks gestation at 1530 g, imaged at 36 + 3-weeks PMA, shows a regressing stage 2 ROP in zone 2 anterior on the 'Neo' (*top panel*) and on the RetCam (*lower panel*).

with Yates continuity correction, $P = 0.68$); similarly, tachycardia was seven (5%) and nine (6.4%), respectively ($P = 0.54$).

As per the first definition of hypoxia (oxygen concentration of $<80\%$ ≥ 30 seconds), the number of episodes in the 1-hour period before the procedure was four (2.9%) as compared with two (1.4%) in the period between immediately after procedure to 1 hour after (McNemar's test with Yates continuity correction, $P = 0.45$). As per the second definition (drop in oxygen $>20\%$ of baseline; the last reading before procedure was baseline and the last reading at end of 60 minutes after procedure for comparison) there were no episodes of hypoxia.

Summary of Systemic Safety

To summarize the systemic safety results, none of the measured changes were clinically significant and none required any intervention. Hypoxia was seen in no infants at the end of procedure or at the end of 1 hour after the procedure. No screening session had to be stopped due to compromised systemic safety or critically altered as decided clinically by the attending anesthetist who monitored the event. No other systemic study adverse events were recorded at any time interval of the study period.

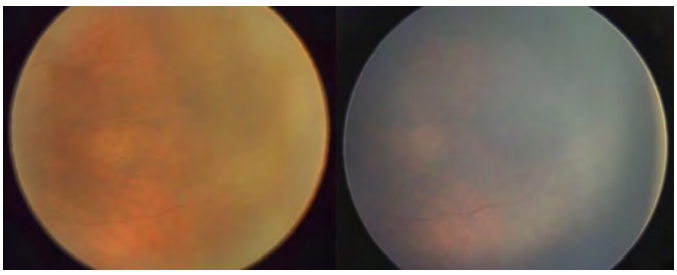


Figure 3. Immature retina imaged at 34-weeks PM) in an infant born at 1760 g and 31-weeks gestation on the 'Neo' (*left*) and on the RetCam (*right*).

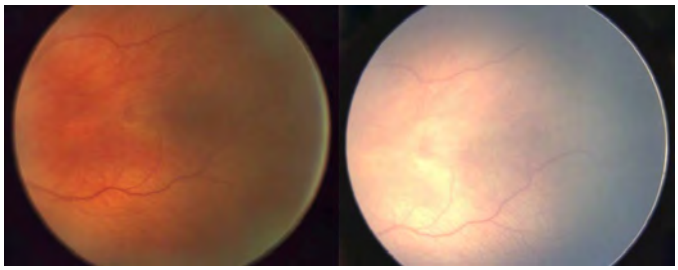


Figure 4. Mature retina imaged in an infant born at 1100 g and 28 weeks showing vessels up to the ora serrata at 42 weeks PMA on the 'Neo' (*left*) and the RetCam (*right*).

Ocular Safety

Ocular adverse events noted were transient redness in two eyes (0.7%) of two infants, which resolved spontaneously after 3 and 4 hours, respectively. No cases of conjunctival laceration, corneal abrasion, eye infection, hyphema, retinal, or vitreous hemorrhages were noted in any study infant.

The technicians did not face any difficulty in imaging infants on the Neo and were able to capture the regions of interest with ease comparable to the RetCam. All sessions complied with the previously published protocols with respect to steps and duration. No session took over 3 minutes.

Case Illustration of Image Comparison Between Neo and RetCam

The square Neo images were cropped from its original square to resemble the rectangular images of the RetCam. An ongoing comparative study between the two devices will be subsequently reported.

In case 1 (Fig. 2), an infant born at 32-weeks gestation with 1530 g, imaged at 36 + 3-weeks PMA, shows a regressing stage 2 ROP in zone 2 anterior on the 'Neo' (top panel) and on the RetCam (lower panel).

In case 2 (Fig. 3), immature retina imaged at 34-weeks PMA in an infant born at 1760 g and 31-weeks gestation on the 'Neo' (left) and on the RetCam (right).

In case 3 (Fig. 4), mature retina imaged in an infant born at 1100 g and 28 weeks showing vessels up

to the ora serrata at 42-weeks PMA on the 'Neo' (left) and the RetCam (right).

Discussion

In the current scenario in India and other middle-income countries, the number of ROP specialists required to screen the increasing number of premature infants is grossly inadequate. Onsite, binocular indirect ophthalmoscopy performed by an ROP specialist, has several limitations in these low human resource settings. These include, the scarcity of trained specialists, lack of objectivity, lack of photo-documentation, medicolegal concerns, low or no reimbursement, remote or poorly accessible locations of neonatal care centers, and ergonomic and logistic difficulties.[18] For these reasons, a majority of semi-urban and rural neonatal care units in India have no ROP screening programs.

In some regions of the world, wide-field imaging provides an adjunctive role to the existing model, by assisting the ROP specialist who is performing on-site exams to confirm or document his or her findings. Tele-ROP on the other hand, is the practical use of wide-field imaging in a formal telemedicine network and has the potential of providing ROP care where there are few or no specialists, ensuring the continuity of care of these infants. This has been made possible for several decades with the availability of the current gold standard, the RetCam imaging systems (Clarity MSI).[19–23]

In India, tele-ROP has been successfully employed for over a decade to screen in remote rural centers.[7,8,10,12,24] The scalability of this program has been limited owing to the high costs incurred in its setting up. This requires a public and private partnership to make it financially and logistically sustainable.[6,13] Despite government funding, the high cost of the camera limits the number of units that can be used within a state or district.[8] This leaves a vast majority of remote centers unscreened.

The Neo was developed to be able to fill this void of low-cost infant retinal devices and took 36 months of multiple prototype validation. Some of the modifications related to improving the ergonomic design, portability, light source, patented liquid-lens systems, weight, and the size. After the device secured successful safety certificates for biomedical parameters it was used for clinical validation. This manuscript focuses on the systemic and ocular adverse effects on 140 infants who underwent Neo imaging.

Using standard definitions of systemic study parameters (Table 2), we measured observed changes during, 5 minutes postimaging and an hour after the imaging session. These were compared with available studies of systemic changes using RetCam imaging.[25,26,27] The heart rate increased by approximately 10 bpm during the procedure, which settled down to an increase of 3 bpm by the end of 5 minutes and an increase of 1 bpm at the end of 1 hour. Our results are consistent with Mukherjee et al.[25] who also found a mean increase of 13 bpm during the procedure and Mehta et al.[27] who found 12 bpm during the procedure. Both these studies reported a reduction in the heart rate by 10 minutes. Our results at the end of 60 minutes, compares well with Mehta et al.[27] who found that the heart rate settled to baseline at end of 30 minutes and differs from Mukherjee et al.[25] who reported a reduction in the heart rate by 5 bpm at end of 30 minutes. Wade et al.[28] reported 0.7% tachycardia compared with our 2.1%. However, in their study, RetCam imaging was used only as an adjunct over indirect ophthalmoscopy and was stopped as soon as the heart rate fluctuated.

From a clinical perspective, bradycardia is of concern to the treating neonatologist who is often responsible for monitoring the baby during ROP screening. We found that 3.6% of our infants had bradycardia. This was significantly lower than 11.9% reported by Mukherjee et al.[25] Studies that recorded bradycardia using indirect ophthalmoscopy have also reported higher levels of 24%[29] and 31%.[30] The relatively short duration of our imaging session and the lesser systemic stress as we did not use scleral indentation could have contributed to the lower incidence of bradycardia in our series.[31]

The mean oxygen concentration drop in our study was 1.9%, which is lower than previous reports of 3%[25] and 7%.[30] This is probably due to their longer screening duration and a smaller sample size ($n = 15$), respectively, in these studies. Desaturation was observed in 8.6% of examinations with the RetCam.[32] The lack of uniform definitions across studies makes comparisons difficult. Mukherjee et al.[25] reported 1.5% examinations with hypoxia when more than 20% of the base line was used as a cut-off. We had no episodes of hypoxia in the 1-hour period after the imaging session with the Neo. However, it must be mentioned that our study cohort was uniformly Asian Indian preterm infants. Infants undergoing ROP screening in our cohort are heavier and older compared with their counterparts in the Western world. This may limit the influence of generalizability of our results to other such population cohorts.

To summarize the systemic safety results, no baby required any extra intervention for correction of any of the systemic changes recorded during or after the procedure suggesting the systemic safety of the Neo. Similarly, ocular safety was established by the presence of only two babies showing transient conjunctival hyperemia after the procedure with no other adverse ocular or adnexal effect during or after the procedure.

Future Directions

After the safety profile of the Neo was established, the ethics committee approved a larger multicenter study that would compare the usability and image quality between the Neo and the RetCam using real-world metrics required in tele-ROP algorithms. The significant financial advantage is likely to promote the use of this device in low-volume neonatal units, which could previously not afford the RetCam. Furthermore, the smaller size and improved portability could allow the Neo to be taken to remote rural centers more easily than the RetCam. The potential advantage of smaller vehicles required to transport the Neo could also add to this cost benefit. A cost-benefit study comparing the direct and indirect costs between the two devices using real-world expenses in a tele-ROP model of screening will be required to explore its full potential.

Conclusion

To conclude, this report demonstrates the systemic and ophthalmic safety of a newly introduced wide-field, infant retinal camera, the Neo, for use in preterm infants who are at risk for ROP. The device has some promising novel features, which include the liquid-lens systems to dynamically focus the image, an LED light source, an integrated lens hand-piece, which is ergonomically lighter and more portable. The most distinct advantage of the device is the cost. Further studies comparing the Neo head-to-head with the RetCam in the real world and cost-utility assessments are necessary to validate the same.

Acknowledgments

The authors thank Padmanaba Holla, Manjunath Chandrashekaraiah, and Ujjal Datta from Forus Health, and Sivakumar Munusamy and Narasimha Krishnan from KIDROP for imaging these infants.

Funding from Grant-in-aid by Department of Biotechnology, BIRAC (Biotechnology Industry Research Assistance Council), Government of India, New Delhi.

The authors alone are responsible for the content and writing of the paper. The Neo device was provided by the manufacturer for the purpose of the study.

Disclosure: **A. Vinekar**, None; **S.V. Rao**, Founder and Director, Forus (E); **S. Murthy**, Forus Health, Bangalore, India (C); **C. Jayadev**, None; **M.R. Dogra**, None; **A. Verma**, None; **B. Shetty**, None

References

1. The global action report on preterm birth born too soon. Available at: http://www.who.int/pmnch/media/news/2012/201204_borntoosoon-report.pdf. Accessed June 20, 2017.
2. Sanghi G, Dogra MR, Katoch D, Gupta A. Demographic profile of infants with stage 5 retinopathy of prematurity in North India: implications for screening. *Ophthalmic Epidemiol*. 2011;18:72–74.
3. Gilbert C, Rahi J, Eckstein M, O'Sullivan J, Foster A. Retinopathy of prematurity in middle-income countries. *Lancet*. 1997;350:12–14.
4. Gilbert C, Fielder A, Gordillo L, et al. Characteristics of infants with severe retinopathy of prematurity in countries with low, moderate, and high levels of development: implications for screening programs. *Pediatrics*. 2005;115:e518–e25.
5. Report in the Supreme Court of India, Civil Appellate Jurisdiction. 2015. Available at: http://supremecourtofindia.nic.in/FileServer/2015-07-02_1435823185.pdf. Accessed February 7, 2018.
6. Vinekar A. IT-enabled innovation to prevent infant blindness in rural India: the KIDROP experience. *J Indian Bus Res*. 2011;3:98–102.
7. Vinekar A, Avadhani K, Dogra M, et al. A novel, low-cost method of enrolling infants at risk for retinopathy of prematurity in centers with no screening program: the REDROP study. *Ophthalmic Epidemiol*. 2012;19:317–321.
8. Vinekar A, Jayadev C, Mangalesh S, Shetty B, Vidyasagar D. Role of tele-medicine in retinopathy of prematurity screening in rural outreach centers in India - a report of 20, 214 imaging sessions in the KIDROP program. *Semin Fetal Neonatal Med*. 2015;20:335–345.
9. Trese MT. What is the real gold standard for ROP screening? *Retina*. 2008;28(3 Suppl):S1–S2.

10. Vinekar A, Gilbert C, Dogra M, et al. The KIDROP model of combining strategies for providing retinopathy of prematurity screening in underserved areas in India using wide-field imaging, tele-medicine, non-physician graders and smart phone reporting. *Indian J Ophthalmol*. 2014;62:41–49.
11. Hungi B, Vinekar A, Datti N, et al. Retinopathy of prematurity in a rural neonatal intensive care unit in South India–a prospective study. *Indian J Pediatr*. 2012;79:911–915,
12. Vinekar A, Jayadev C, Mangalesh S, et al. Initiating retinopathy of prematurity screening before discharge from the neonatal care unit: effect on enrolment in rural India. *Indian Pediatr*. 2016;53(Suppl 2):S107–S111.
13. Karnataka Internet Assisted Diagnosis of Retinopathy of Prematurity (KIDROP): program evaluation based on CDC guidelines. 2015. Available at: http://www.paediatrics.uwa.edu.au/__data/assets/pdf_file/0008/2816783/KIDROP-report-2015.pdf. Accessed February 7, 2018.
14. Vinekar A, Dogra MR, Jayadev C, Murthy S, Rao SV, Shetty B. Evaluation of a new, low-cost, portable, wide-field, digital, retinal camera, "Neo" for screening infants for retinopathy of prematurity – a prospective, multi-center, validation report in Asian Indian infants. *Invest Ophthalmol Vis Sci*. 2016;57(12).
15. Pejaver R, Bilagi A, Vinekar A, Bilagi P. National Neonatology Foundation's evidence based clinical practice guidelines for retinopathy of prematurity, NNF India, guidelines. January 2010. Available at: https://www.scienceopen.com/document?vid=3bfe12b1-64da-41ad-ae31-55cdf1d2a12e. Accessed June 20, 2017.
16. Lowry R. vassarstats.net. Available at: http://vassarstats.net/. Accessed February 7, 2018.
17. Faul F, Erdfelder E, Lang A-G, Buchner A. G*Power: a flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behav Res Methods*. 2007;39:175–191.
18. Vinekar A, Jayadev C, Shetty B, al. et. Telemedicine in retinopathy of prematurity. *Adv Ophthalmol Optom*. 2016;1:193–210.
19. Ells AL, Holmes JM, Astle WF, et al. Telemedicine approach to screening for severe retinopathy of prematurity. *Ophthalmology*. 2003;110:2113–2117.
20. Dai S, Chow K, Vincent A. Efficacy of wide-field digital retinal imaging for retinopathy of prematurity screening. *Clin Exp Ophthalmol*. 2011;39:23–29.
21. Fijalkowski N, Zheng LL, Henderson MT, et al. Stanford University Network for Diagnosis of Retinopathy of Prematurity (SUNDROP): five years of screening with telemedicine. *Ophthalmic Surgery, Lasers Imaging Retin*. 2014;45:106–113.
22. Quinn GE, Ying G, Daniel E, et al. Validity of a telemedicine system for the evaluation of acute-phase retinopathy of prematurity. *JAMA Ophthalmol*. 2014;132:1178–1184.
23. Lorenz B, Spasovska K, Elflein H, Schneider N. Wide-field digital imaging based telemedicine for screening for acute retinopathy of prematurity (ROP). Six-year results of a multicentre field study. *Graefes Arch Clin Exp Ophthalmol*. 2009;247:1251–1262.
24. Vinekar A, Jayadev C, Bauer N. Need for telemedicine in retinopathy of prematurity in middle-income countries. *JAMA Ophthalmol*. 2015;133:360–361.
25. Mukherjee AN, Watts P, Al-Madfai H, Manoj B, Roberts D. Impact of retinopathy of prematurity screening examination on cardiorespiratory indices a comparison of indirect ophthalmoscopy and retcam imaging. *Ophthalmology*. 2006;113:1547–1552.
26. Mitchell AJ, Green A, Jeffs D a., Roberson PK. Physiologic effects of retinopathy of prematurity screening examinations. *Adv Neonatal Care*. 2011;11:291–297.
27. Mehta M, Adams GGW, Bunce C, Xing W, Hill M. Pilot study of the systemic effects of three different screening methods used for retinopathy of prematurity. *Early Hum Dev*. 2005;81:355–360.
28. Wade KC, Pistilli M, Baumritter A, et al. Safety of retinopathy of prematurity examination and imaging in premature infants. *J Pediatr*. 2015;167:994–1000.e2.
29. Laws DE, Morton C, Weindling M, Clark D, Clark D, Laws D. Systemic effects of screening for retinopathy of prematurity. *Br J Ophthalmol*. 1996;80:425–428.
30. Clarke WN, Hodges E, Noel LP, Roberts D, Coneys M. The oculocardiac reflex during ophthalmoscopy in premature infants. *Am J Ophthalmol*. 1985;99:649–651.
31. Belda S, Pallás CR, de la Cruz J, Tejada P. Screening for retinopathy of prematurity: is it painful? *Neonatology*. 2004;86:195–200.
32. Moral-Pumarega M, Caserío-Carbonero S, De-La-Cruz-Bértolo J, Tejada-Palacios P, Lora-Pablos D, Pallás-Alonso CR. Pain and stress assessment after retinopathy of prematurity screening examination: indirect ophthalmoscopy versus digital retinal imaging. *BMC Pediatr*. 2012;12:132.

Imaging the ora serrata with the 3Nethra Neo camera – Importance in screening and treatment in retinopathy of prematurity

Dear Editor,

Goyal *et al*. describe the use of a condensing lenses with a smartphone attached to a portable, noncontact device to capture retinal images of eyes with retinopathy of prematurity (ROP)[1] Using the iPhone 5S (Apple, Cupertino, USA) and either 20D, 28D, or 40D lenses they were able to achieve 46°, 53°, or 90° of field of view, respectively. The lens and the phone were mounted on a device (MIIRetCam) which was invented for adult fundus imaging. These fields do not qualify as "wide-field" from the perspective of screening for ROP.

The images from the device in their manuscript have high glare artefacts reflecting from the surface of the condensing lens. This is due to the flash of the smart phone, which the authors acknowledge, "is much stronger and divergent than the light source of binocular indirect ophthalmoscope or professional wide-field imaging systems." The authors must address phototoxicity testing which is imperative while imaging the infant retina. The 3Nethra Neo Camera (Forus Health, India)[2] and the RetCam Shuttle (Natus, USA), which the authors compare their device with, were extensively tested for light and electrical safety before the use on human subjects.

Obtaining oriented images is also a challenge when a noncontact imaging camera like the MIIRetCam is used on awake, preterm infants. Only two of the 16 images in their third figure, are correctly oriented, with the others obliquely slanted or with a quadrant – location mismatch. To a large extent, contact devices eliminate this limitation.

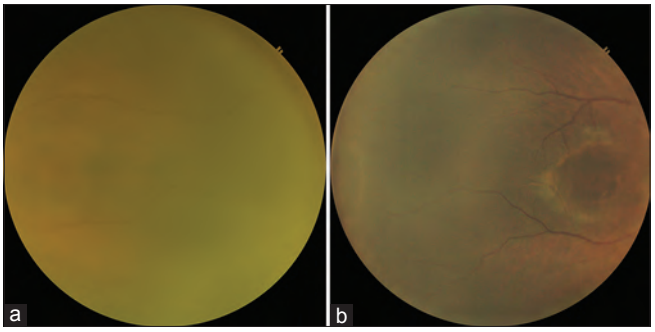


Figure 1: Ora serrata imaged during ROP screening on the Neo Camera (Forus Health, India). (a) Left eye showing a mature retina, with vascularization reaching the ora serrata. This allows the baby to be discharged from screening. (b) Right eye showing one clock hour of stage 1 ROP in zone 3 and the ora serrata anterior to it

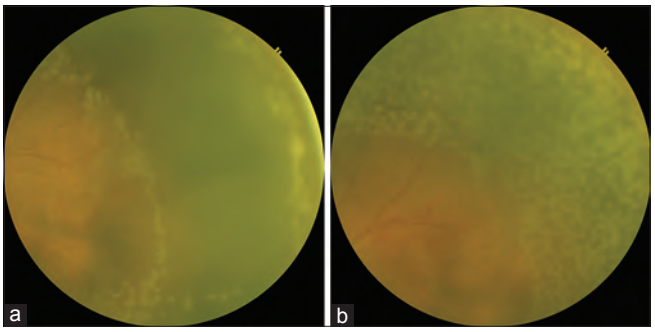


Figure 2: Ora serrata imaged during ROP laser treatment on the Neo Camera (Forus Health, India). (a) Left eye- temporal quadrant showing laser marks at the ora serrata (and part of the posterior border) at the initiation of the laser procedure to mark the anterior extent of the treatment. This method is often performed during training for laser. (b) The same quadrant at the completion of the laser which demonstrates adequacy of laser until the ora serrata

The authors allude to the KIDROP program and compare their process with it. Although they describe a single operator who captures all the study images, they agree that a "nurse assistant is needed to hold the head during examination."[1] This is effectively the same as the KIDROP program, where only "one" trained technician is needed for capture per geographic area. KIDROP nonphysician imagers are trained not only to image, but also to grade and report simultaneously, as well as receive a validated review by the specialist within 15 min.[3] This obviates the need of the limited ROP specialists we face in the country. The MIIRetCam needs to be tested in the hands of nonophthalmologists before its consideration as a telemedicine tool in the outreach.

Finally, Goyal *et al*. mention that the "Optos ultrawide camera, RetCam Shuttle, and the 3Nethra Neo" are "unable to image out to the ora serrata." Whereas the former two cameras are well known as wide-field retinal cameras and have a published track record of imaging the retinal periphery including the ora serrata, we present images from the Neo device which depicts the ora serrata in a mature retina [Fig. 1a] and Type 2 ROP [Fig. 1b] and during laser treatment [Fig. 2a and b]. The KIDROP program uses the depiction of the ora serrata (on both the RetCam shuttle and the Neo) in both eyes to demonstrate a "fully vascularized" or mature retina before the infant is discharged from the screening protocol.[4,5] The depiction of the ora serrata is also used for determining the adequacy of laser treatment [Fig. 2].

Devices like the MIIRetCam serve as a cost-effective tool for photodocumentation in the office setting. A tool for telemedicine especially in the outreach requires more than just a device.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

Anand Vinekar, Mangat Ram Dogra[1], Bhujang Shetty

Department of Pediatric Retina, Narayana Nethralaya Eye Institute, Rajajinagar, Bengaluru, Karnataka, [1]Advanced Eye Center, Postgraduate Institute of Medical Education and Research, Chandigarh, India

Correspondence to: Dr. Anand Vinekar, Department of Pediatric Retina, Narayana Nethralaya Eye Institute, Bengaluru, Karnataka, India.
E-mail: anandvinekar@yahoo.com

References

1. Goyal A, Gopalakrishnan M, Anantharaman G, Chandrashekharan DP, Thachil T, Sharma A. Smartphone guided wide-field imaging for retinopathy of prematurity in neonatal intensive care unit - A Smart ROP (SROP) initiative. Indian J Ophthalmol 2019;67:840-5.
2. Vinekar A, Rao SV, Murthy S, Jayadev C, Dogra MR, Verma A, *et al*. A novel, low-cost, wide-field, infant retinal camera, "Neo": Technical and safety report for the use on premature infants. Transl Vis Sci Technol 2019;8:2.
3. Vinekar A, Jayadev C, Bauer N. Need for telemedicine in retinopathy of prematurity in middle-income countries: e-ROP vs KIDROP. JAMA Ophthalmol 2015;133:360-1.
4. Vinekar A, Gilbert C, Dogra M, Kurian M, Shainesh G, Shetty B, *et al*. The KIDROP model of combining strategies for providing retinopathy of prematurity screening in underserved areas in India using wide-field imaging, tele-medicine, non-physician graders and smart phone reporting. Indian J Ophthalmol 2014;62:41-9.
5. Vinekar A, Jayadev C, Mangalesh S, Shetty B, Vidyasagar D. Role of tele-medicine in retinopathy of prematurity screening in rural outreach centers in India - A report of 20,214 imaging sessions in the KIDROP program. Semin Fetal Neonatal Med 2015;20:335-45.

Access this article online	
Quick Response Code:	Website: www.ijo.in
	DOI: 10.4103/ijo.IJO_1232_19

Cite this article as: Vinekar A, Dogra MR, Shetty B. Imaging the ora serrata with the 3Nethra Neo camera – Importance in screening and treatment in retinopathy of prematurity. Indian J Ophthalmol 2020;68:270-1.

3nethra neo

SCREENING PROCEDURE

Screening Procedure is carried out inside a neonatal unit or hospital, during a visit by retina specialist or trained operator.

For Whom?

All premature babies should be examined at the earliest for ROP and other retinal problem in babies.

PROCEDURE -1

Fully dilate the eyes of the baby

PROCEDURE - 2

Wrap the baby

PROCEDURE - 3

Disinfect the lens and outer cone of the camera hand-piece with 70% IPA (isopropyl alcohol)

PROCEDURE - 4

Add a few drops of Tobramycin ophthalmic solution (Anaesthesia drops)

PROCEDURE - 5

Use a speculum to keep the eyes open

If treated on time, majority of children will not experience any complications.

Babies with a birthweight of less than 1700 gm or those born before 35 weeks of pregnancy are at the highest risk to develop ROP

PROCEDURE - 6

Apply a biocompatible gel (e.g. lubricant containing 0.3% of hydroxypropyl methylcellulose - HPMC) on the lens of the camera hand-piece and on the eyes of the baby

PROCEDURE - 7

Make sure the baby is positioned correctly for imaging. The operator can choose to sit or stand behind the head of the baby such that the baby's legs are pointing away from the operator

PROCEDURE - 8

Follow the recommended clinical practice at the site.
Software allows tagging of captured images with the following zones:
o Posterior
o Nasal
o Superior
o Temporal
o Inferior
o Disk-centered.

PROCEDURE - 9

After screening, wipe babies's eye and the contact lens. Ensure no gel remains in eye and contact lens.

PROCEDURE - 10

Add antibiotic drops

Why?

ROP can lead to low vision and even blindness. If not detected and treated at the crucial time, it can cause irreversible low vision or even blindness.

ROP SCREENING PROCESS

1. Fully dilate the eyes of the baby

2. Wrap the baby

3. Disinfect the lens and outer cone of the camera hand-piece with 70% IPA (isopropyl alcohol)

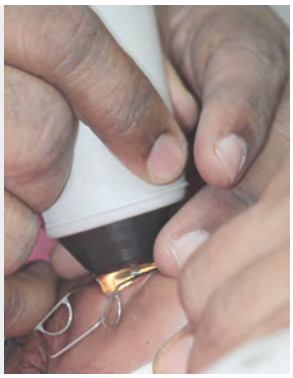
Speculum

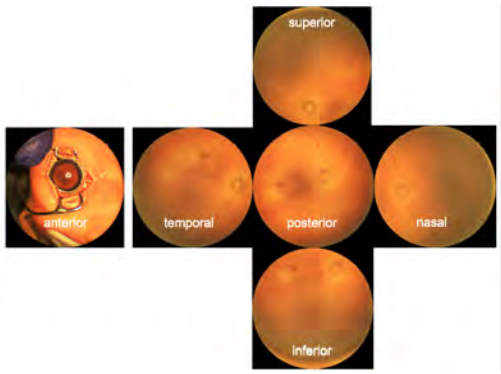
4. Add a few drops of Tobramycin ophthalmic solution (Anaesthesia drops) .
Use a speculum to keep the eyes open.

6. Apply a biocompatible gel (e.g. lubricant containing 0.3% of hydroxypropyl methylcellulose - HPMC) on the lens of the camera hand-piece and on the eyes of the baby

7. Make sure the baby is positioned correctly for imaging. The operator can choose to sit or stand behind the head of the baby such that the baby's legs are pointing away from the operator

8. Follow the recommended clinical practice at the site. Software allows tagging of captured images with the following zones:
o Posterior
o Nasal
o Superior
o Temporal
o Inferior
o Disk-centered.





9. After screening, wipe babies's eye and the contact lens. Ensure no gel remains in eye and contact lens.

10. Add antibiotic drops

Forus Health
Technology delivering care

Forus Health PVT Ltd

#2234, 23rd Cross
Banashankari 2nd Stage
Bengaluru 560070
Karnataka, India
Phone: +91 80 4162 4041 | 4162 4042

Forus Health Inc

20116 Ashbrook Pl, Ste 130
Ashburn VA 20147 USA
Phone: +1 (571) 621 4607

Email: askus@forushealth.com
Website: www.forushealth.com

LET'S

TOGETHER BUILD AN ROP FREE WORLD