

Diabetic eye screening, prevention and treatment

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Diabetes around the world in 2021:



537 million adults (20-79 years) are living with diabetes - 1 in 10. This number is predicted to rise to **643 million** by 2030 and **784 million** by 2045.



Over 4 in 5 (81%) adults with diabetes live in low- and middle-income countries.



Diabetes is responsible for **6.7 million** deaths in 2021 - 1 every 5 seconds.



Diabetes caused at least **USD 966 billion** dollars in health expenditure – a 316% increase over the last 15 years.



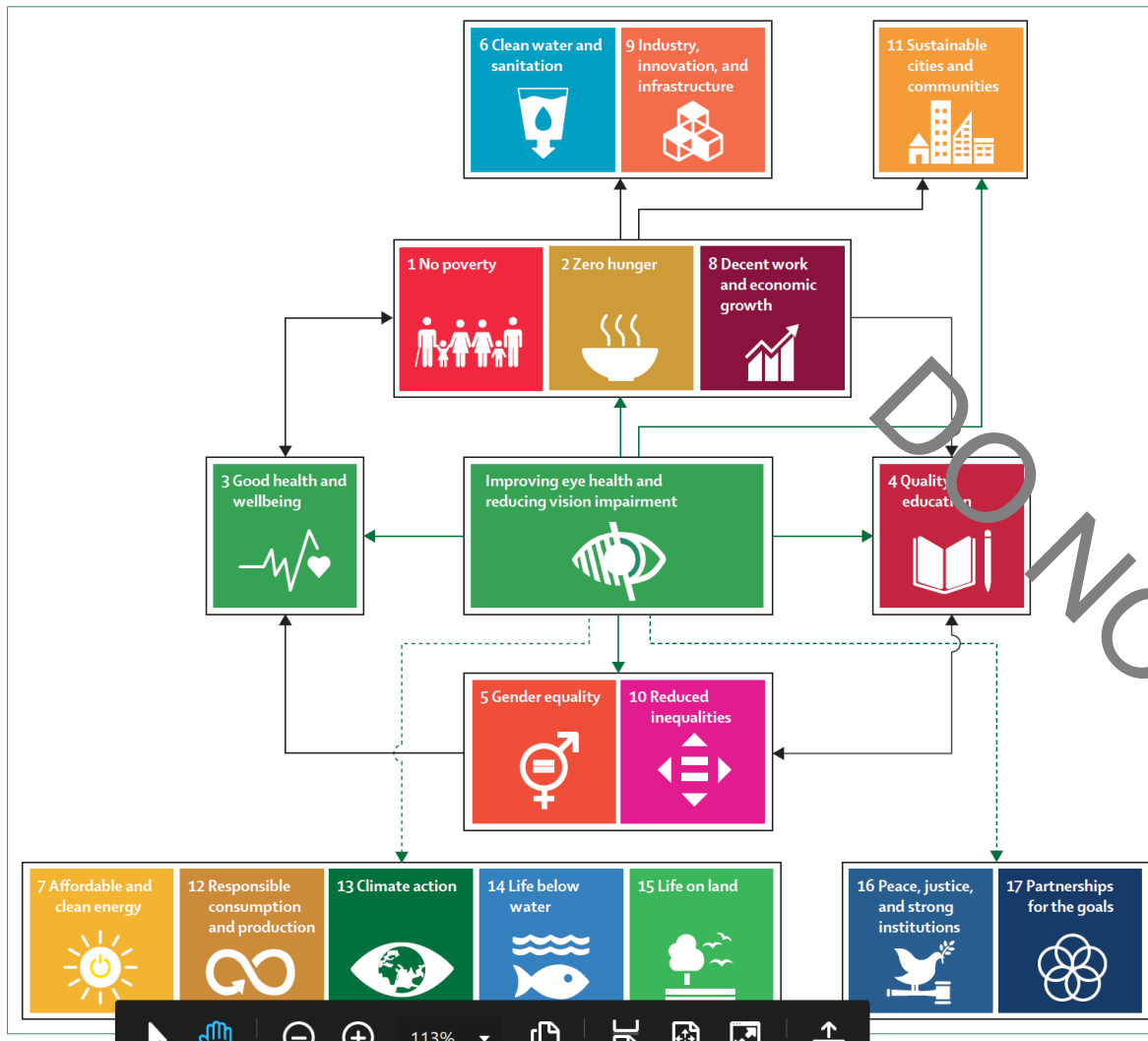
541 million adults have Impaired Glucose Tolerance (IGT), which places them at high risk of type 2 diabetes..

In the IDF 2025 atlas:

589 million people (20-79 yrs) live with diabetes, 90% with Type 2 diabetes

12% of global health expenditure and **9.3%** of global deaths of other causes are attributed to diabetes

1 in 5 live births are affected by hyperglycaemia in pregnancy



Eye-health contributes to Sustainable Development Goals

The Lancet Global Health Commission

The Lancet Global Health Commission on Global Eye Health: vision beyond 2020



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The DR Barometer Global Report: Overview

The DR Barometer study was conducted in 41 countries. Globally 4,340 adults with diabetes and 2,329 health care professionals provided new information about the experiences of living with, managing and treating diabetes, DR and DME.

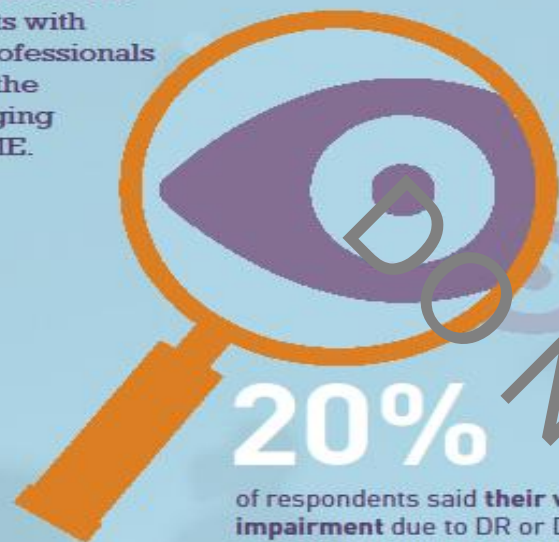
38%

of patients said that **long wait times for an appointment** were a barrier to eye exams



44%

of all providers **did not have, or did not use, written protocols** for the management of diabetes-related vision loss



20%

of respondents said **their vision impairment** due to DR or DME made it **difficult to manage their diabetes**



79%

of patients with vision loss due to DR or DME said that their condition made everyday activities, **such as driving**, working and completing basic household tasks difficult and in some cases impossible



69%

of those with DME experienced days of **poor physical and mental health**

27%

of patients either **never discussed eye complications with their doctor** or did so only after the onset of symptoms



21%

of ophthalmologists **had not received specific training** in the treatment and diagnosis of DR and or DME

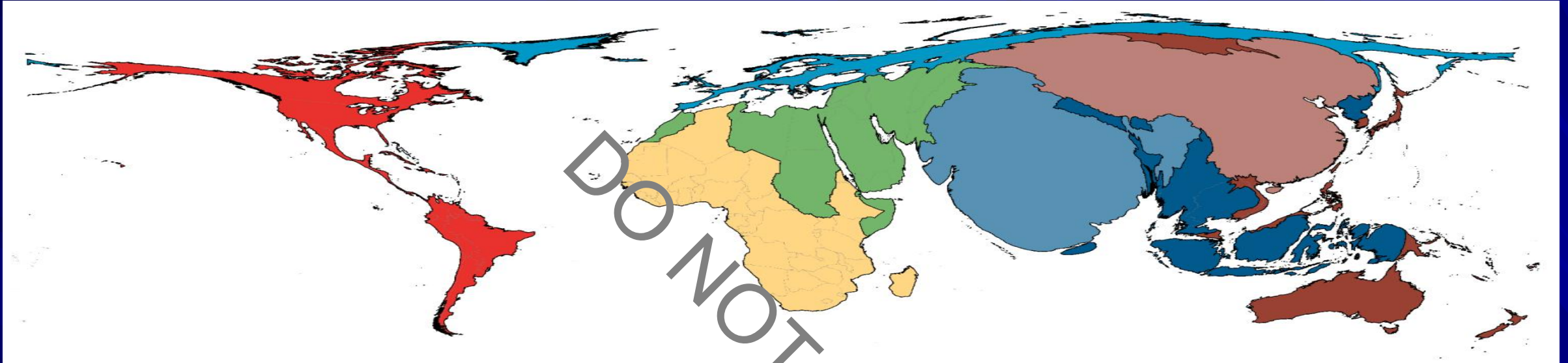


DR: Diabetic Retinopathy
DME: Diabetic Macular Edema

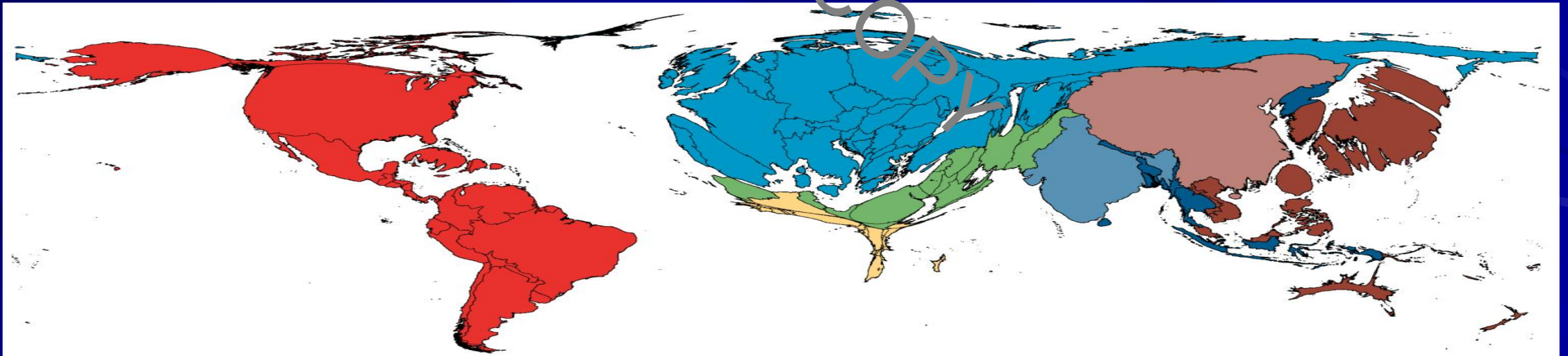
DRBarometer.com



Where are the world's blind people?



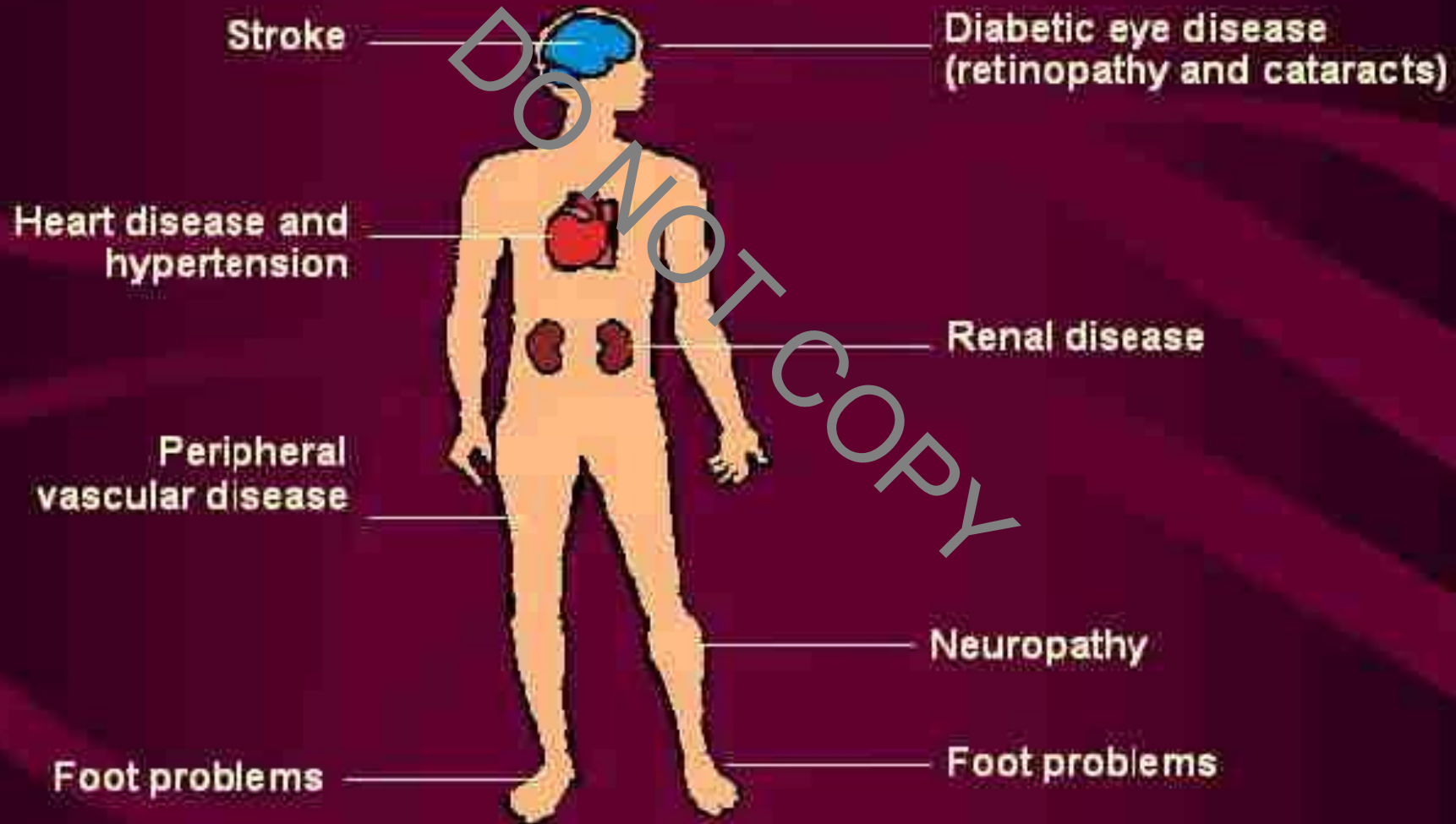
Where are the world's ophthalmologists?



Diabetes: Complications

Macrovascular

Microvascular



The burden of disease

Diabetic Eye Disease

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graph TD; A[Diabetic Eye Disease] --> B[Retinopathy]; A --> C[Maculopathy]; A --> D[Anterior segment disease]; B --> E[Rubeosis/Rubeotic glaucoma]; B --> F[VR surgery]; B --> G[DMO requiring treatment]; C --> H[No treatment required/available]; C --> I[Cataract];
```

The diagram illustrates the progression of Diabetic Eye Disease. It starts with a central box labeled 'Diabetic Eye Disease'. From this box, three arrows point downwards to 'Retinopathy', 'Maculopathy', and 'Anterior segment disease'. 'Retinopathy' further branches into 'Rubeosis/Rubeotic glaucoma', 'VR surgery', and 'DMO requiring treatment'. 'Maculopathy' branches into 'DMO requiring treatment' and 'No treatment required/available'. 'Anterior segment disease' leads to 'Cataract'.

Retinopathy

Rubeosis/Rubeotic
glaucoma

VR surgery

DMO requiring treatment

Anterior segment
disease

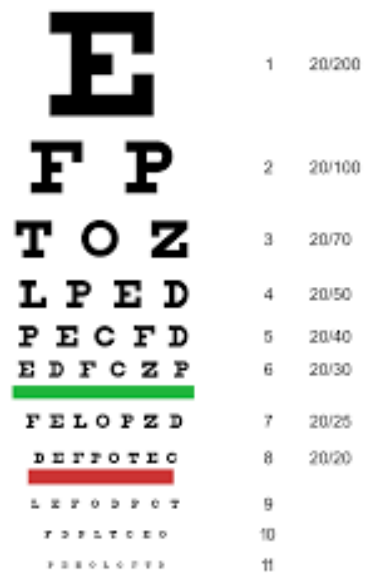
Cataract

Maculopathy

No treatment required/
available

Area photographed in diabetic eye screening :
18-20% of the back of the eye





Visual acuity is taken in some countries

Takes too much time, do it electronically or use home-monitoring of function?

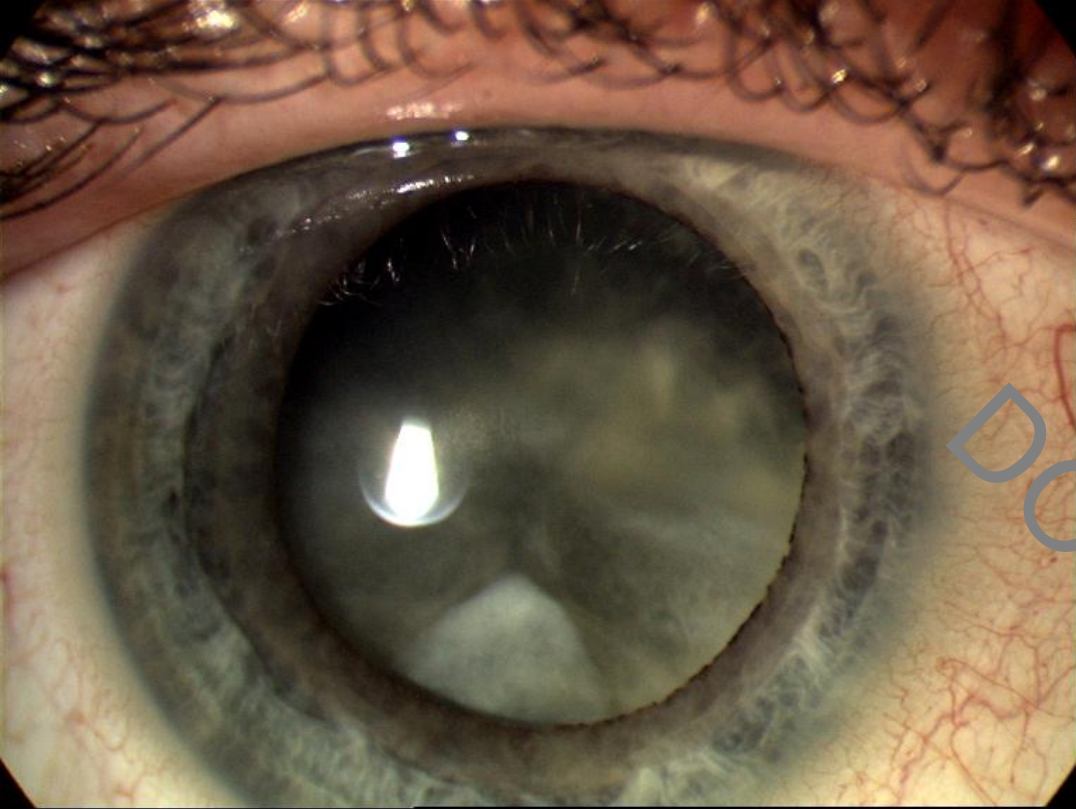
Dilating drops

Sting/cannot read/cannot drive
Acute angle closure glaucoma
Adds time to attendance
New cameras work well without
dilating drops for many



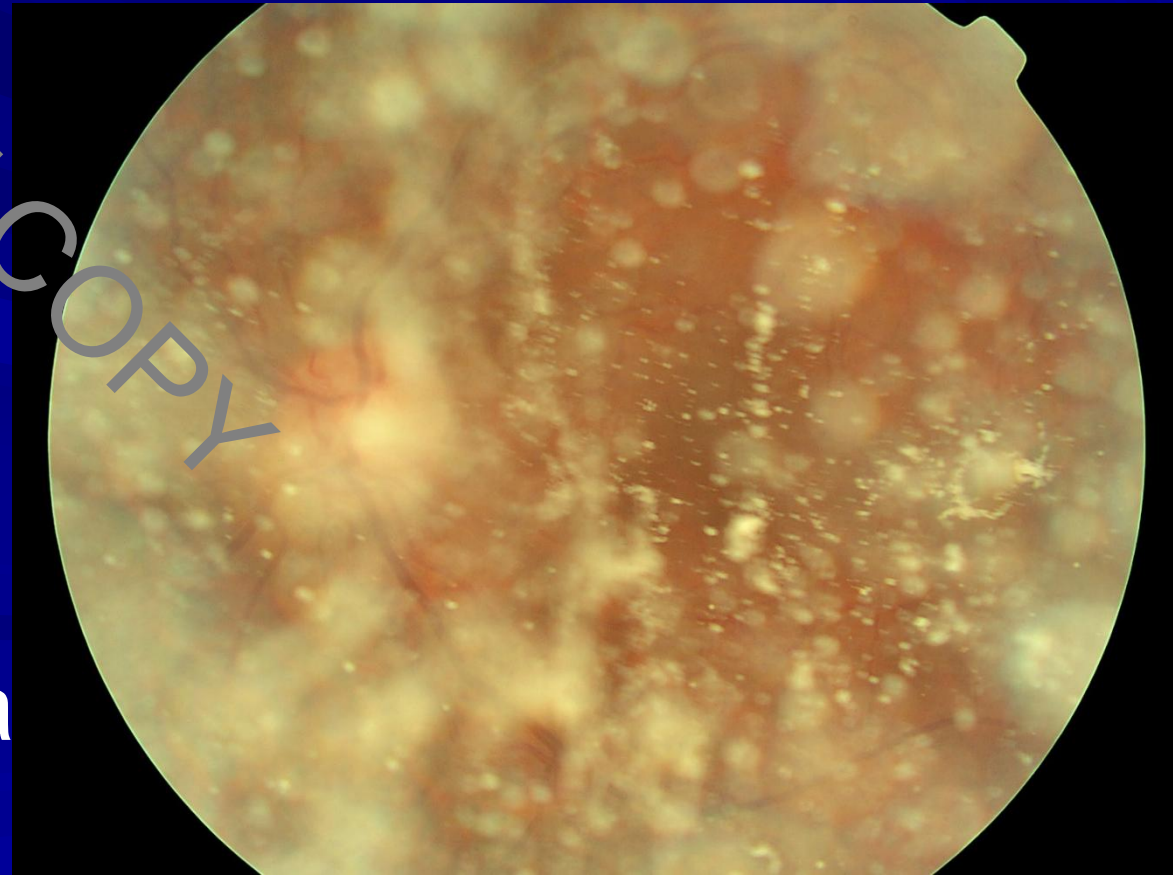


Imaging
the eye



Those with
ungradable images

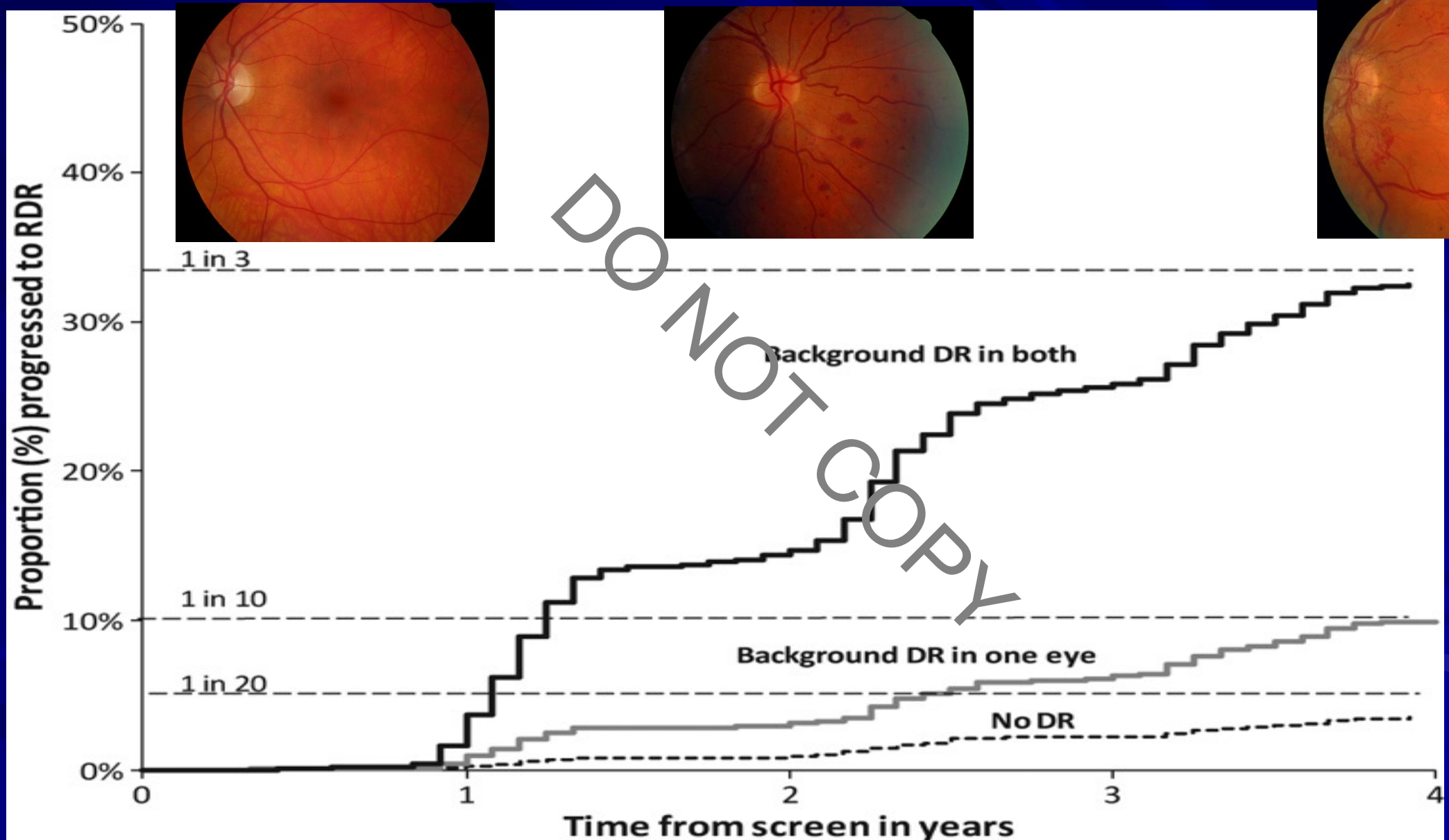
Slitlamp pathway:
Optometrists/ technicians /
doctors check for anterior
segment disease and the retina



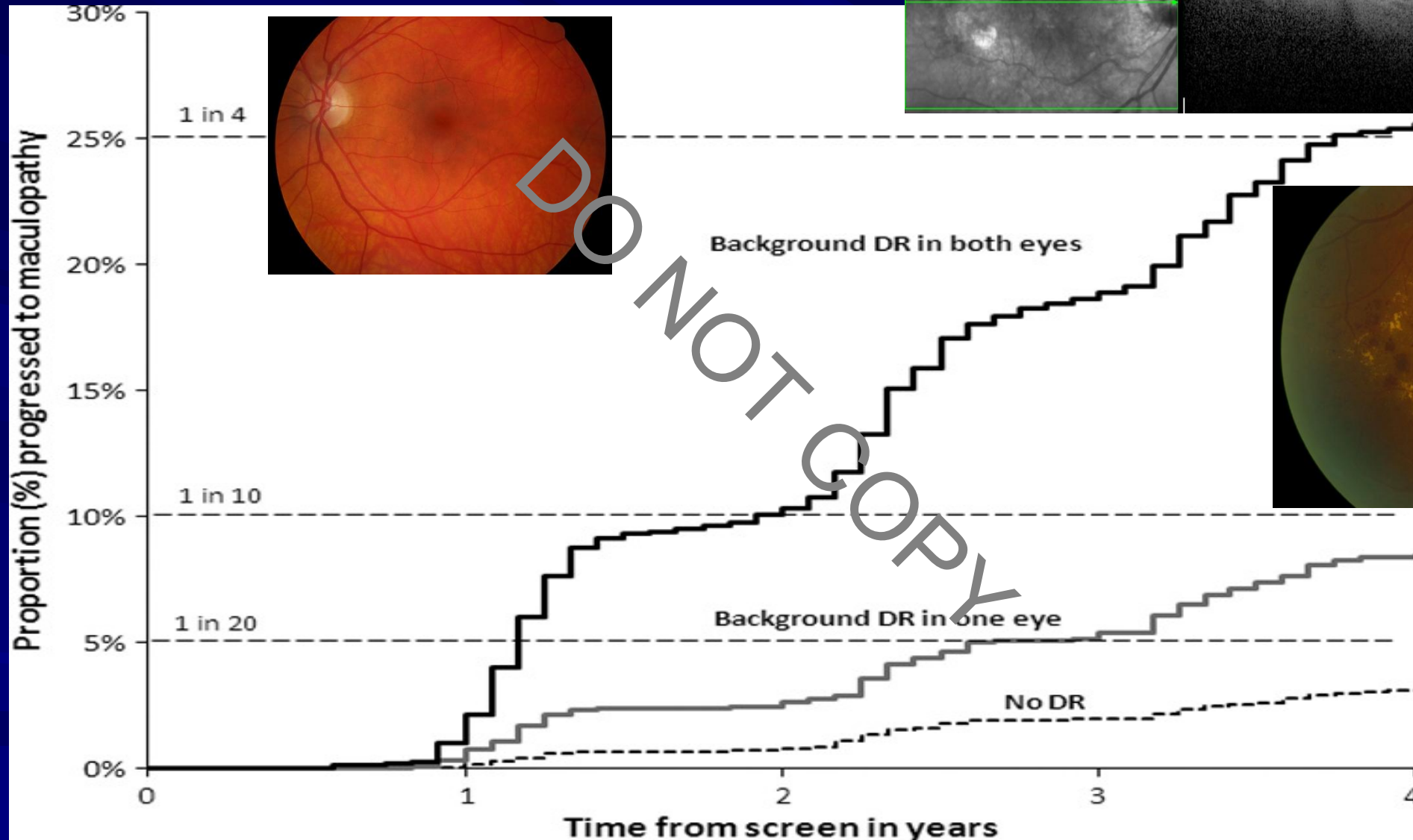
Cataract in patients with diabetes

- Changes in blood sugar level can affect vision as lens swells when blood sugar is high (myopic change) and releases water and shrinks when blood sugar level is low (hypermetropic change)
- Lens returns to normal when blood sugars normalise, so wait for stabilisation in newly diagnosed and unstable patients before suggesting to visit their optometrist
- Patients with diabetes are 2-4 times more likely to develop cataract (15 - 20 times more if <40)

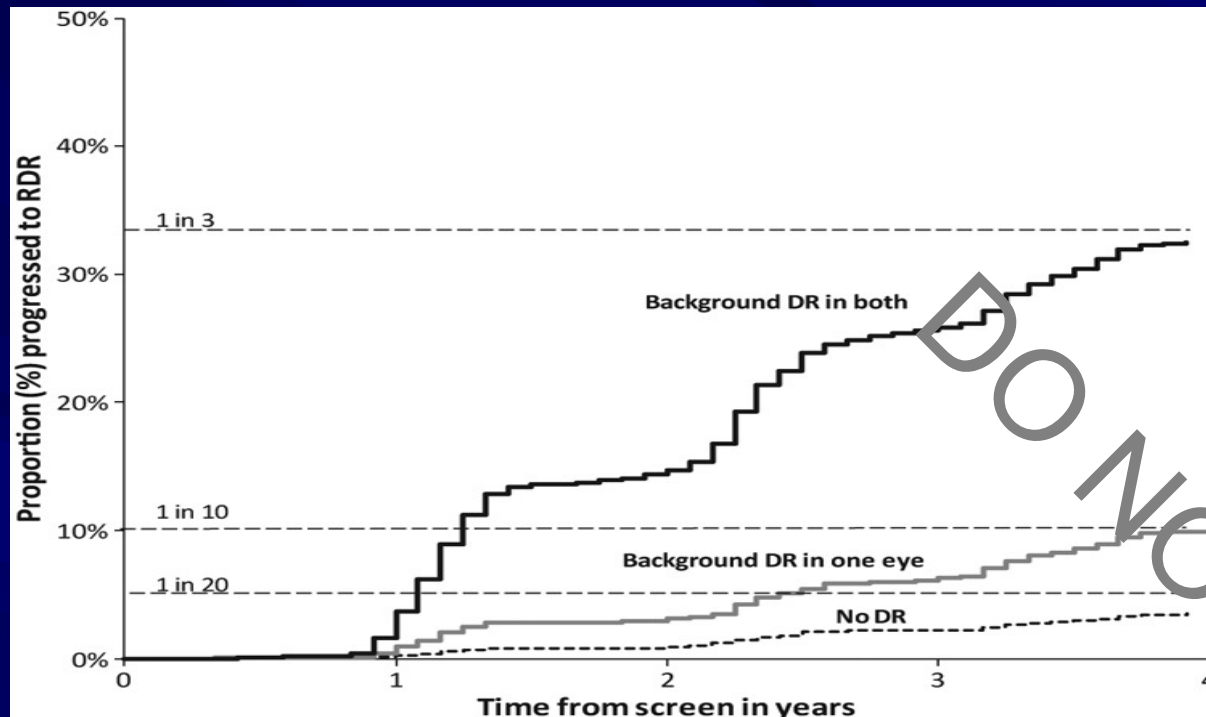
Progression to proliferative disease



And the progression to maculopathy

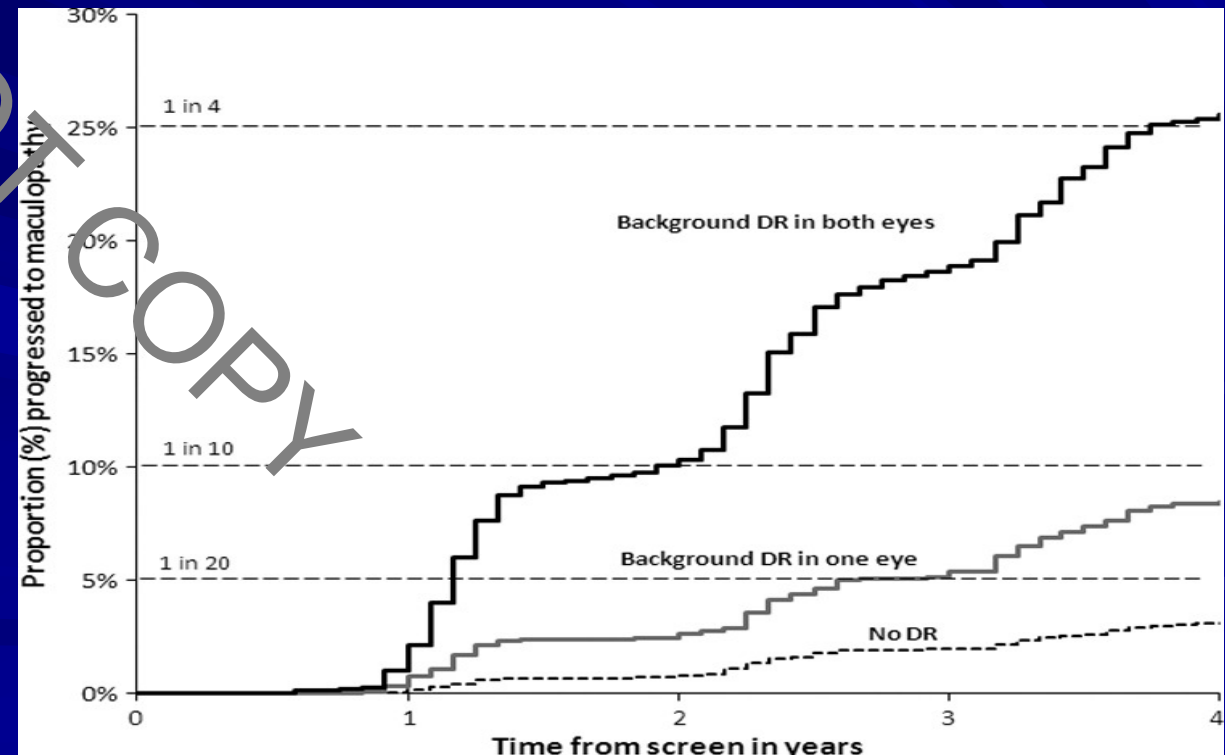


Progression to proliferative disease



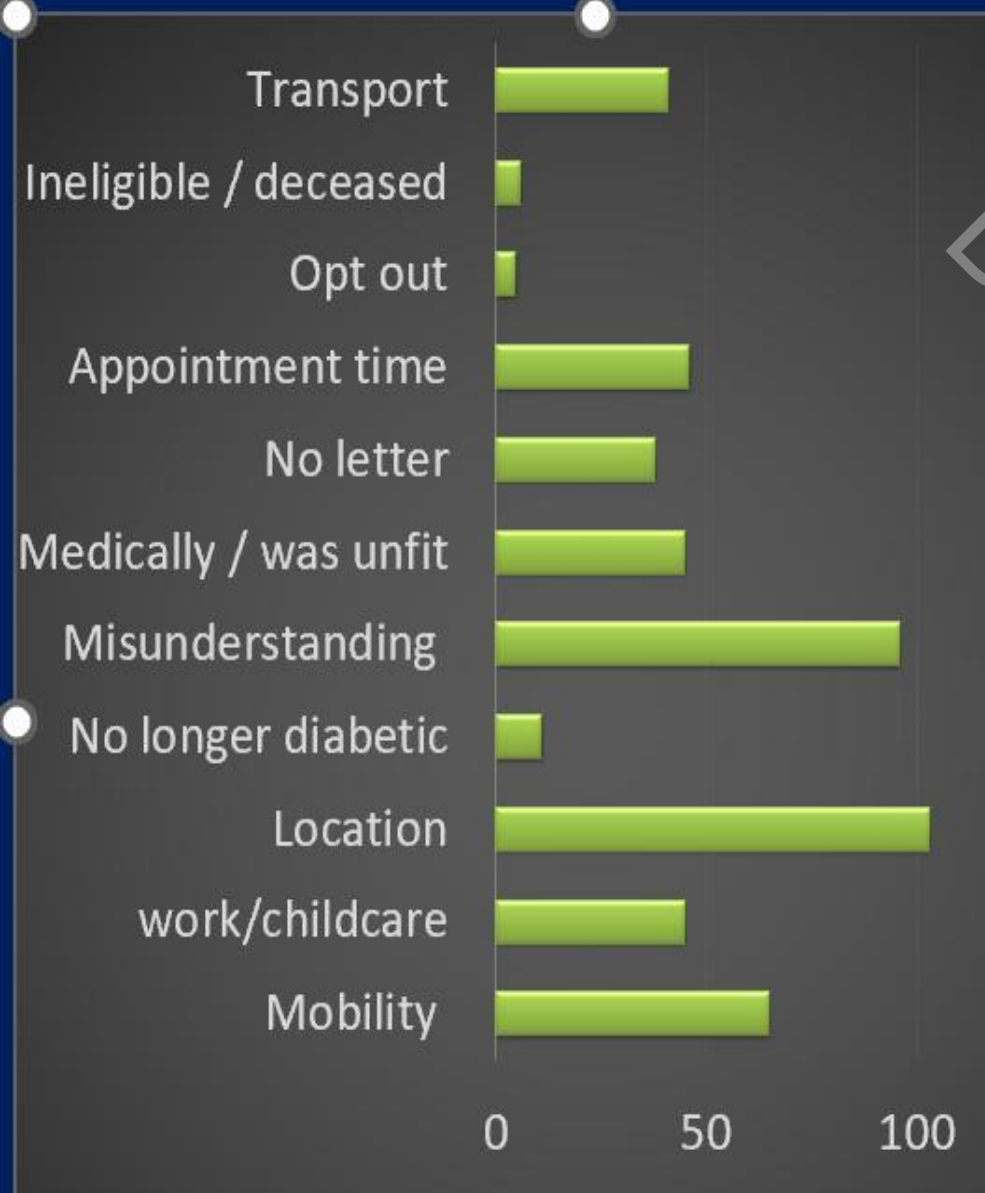
Stratify the patients better

Progression to maculopathy



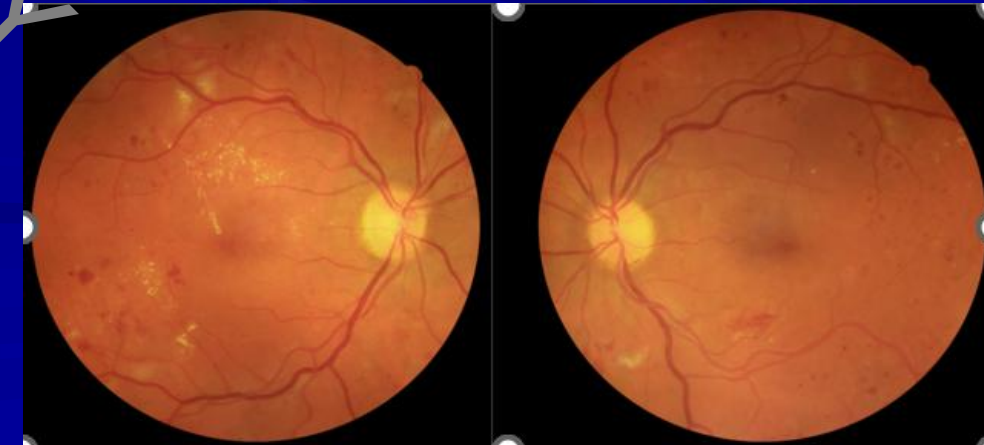
Grading results drive decision making and risk stratification

The UK had DESP for >20 years, but still..



- About 9% regularly do not come
- 501 patients were interviewed who did not attend for over 3 years despite being offered a minimum of 2 appointments per year
- Those DNAd had worse DR/DMO

Patient DNAd for
10 years:
Bilateral PDR
and DMO



How about those who cannot easily come to screening/clinic?

- Standardized diagnostic evaluation for diabetic retinopathy of multiple handheld retinal imaging devices
- Comparison with ultrawide field images, ETDRS standard and optical coherence tomography
- Images acquired by non-physician certified imager-

iNview



Smartscope



Aurora



RV700



Where to now? Mobile Handheld Ultraportable Retinal Imaging Devices

- Multiple cameras in various stages of development
- Typically integrated into a smartphone or mobile computing platform
- Early stages of adoption
- Limited field of view 5-60 degrees
- Require rigorous validation



Keeping safety in mind, we need to

Identify high risk patients reliably

Trial hand-held cameras for dialysis clinics

Work with high-risk foot clinics

Chronic pancreatitis clinics

Young people with diabetes

Portable slitlamp for patients in prisons

Findings in dialysis clinics

- We use the Optomed Aurora camera for imaging the eye
- Traffic light system and in-built AI
- In the UK, 1:429 has PDR in screening; in the dialysis centres, 1:4 required referral for the same!

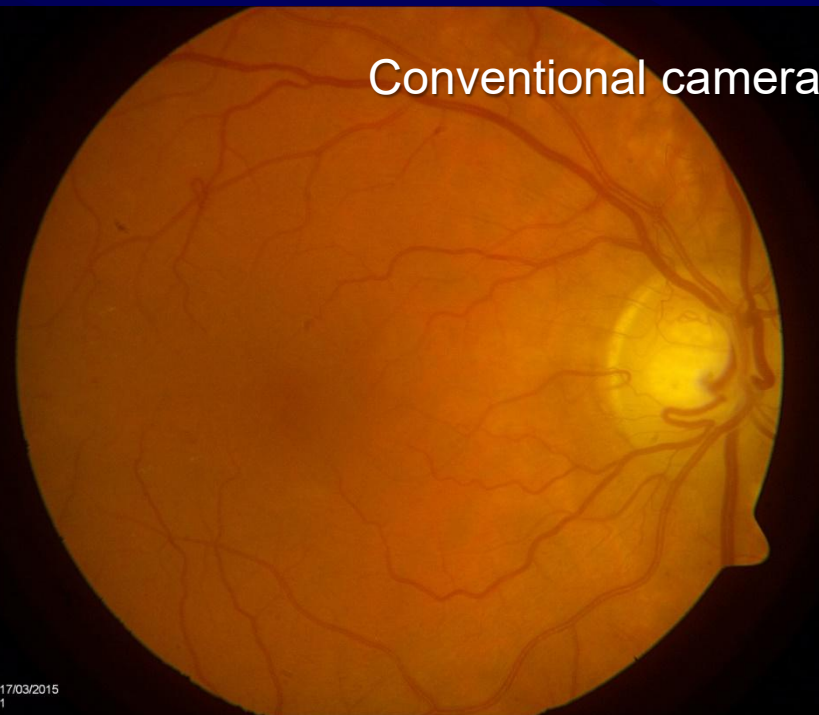


Optomed Aurora

Pathways in Diabetic Eye Screening pathway

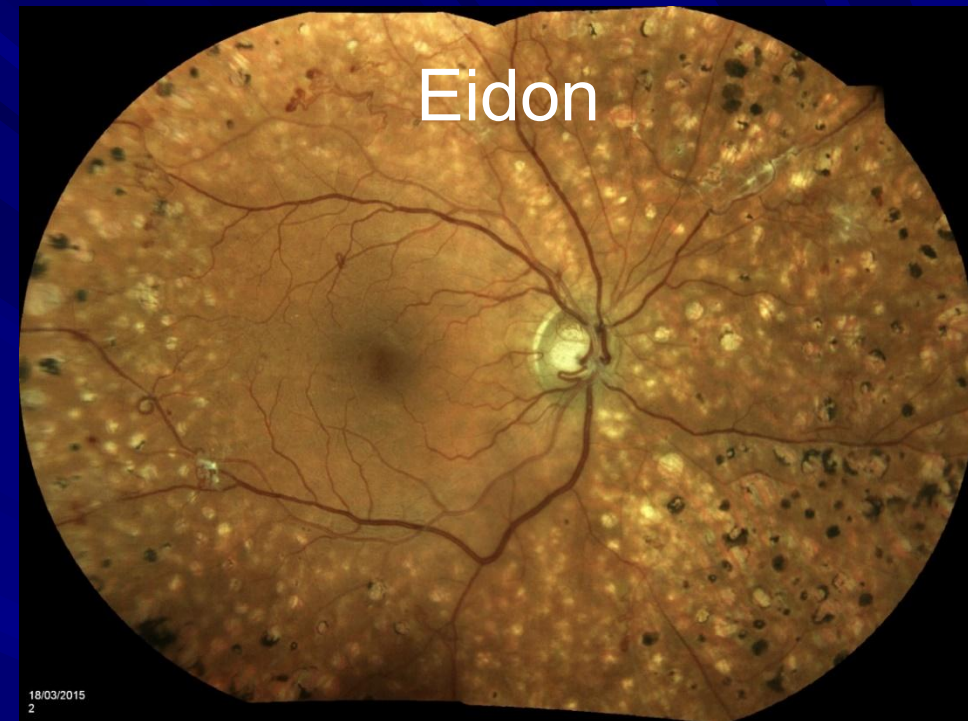
- Standard screening pathway – annual or 2-yearly
- Digital Surveillance pathway – 3 monthly for pregnant ladies; 6-12 months options for others
- Slitlamp pathway – for those with ungradable images
- Referral pathways to clinics

Conventional camera

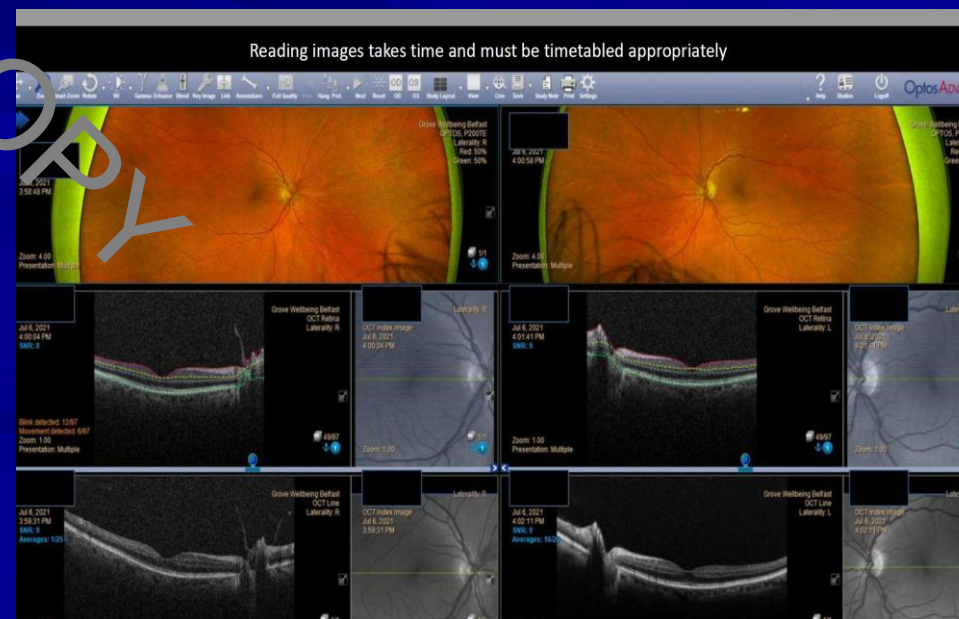


In clinical
setting different
cameras might
be used

Eidon



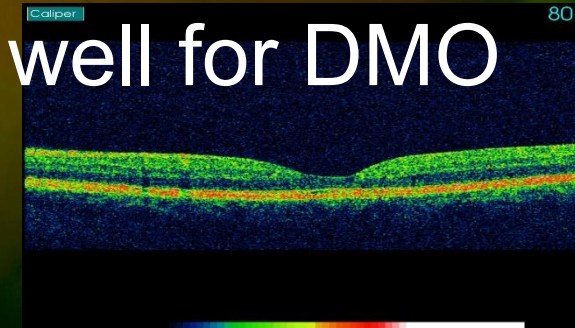
Optos



1:9 have a more severe disease once the periphery is examined

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OCT scans are done as well for DMO



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Peripheral Lesions Identified by Mydriatic Ultrawide Field Imaging: Distribution and Potential Impact on Diabetic Retinopathy Severity

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Objective: To assess diabetic retinopathy (DR) as determined by lesions identified using mydriatic ultrawide field imaging (DGLC200; Optos plc, Scotland, UK) compared with Early Treatment Diabetic Retinopathy Study (ETDRS) 7-standard field film photography.

Design: Prospective comparative study of DGLC200, ETDRS 7-standard field film photography, and dilated fundus examination (DFE).

Participants: A total of 206 eyes of 103 diabetic patients selected to represent all levels of DR.

Methods: Subjects had DGLC200, ETDRS 7-standard field film photographs, and DFE. Images were graded for severity and distribution of DR lesions. Discrepancies were adjudicated, and images were compared side by side.

Main Outcome Measures: Distribution of hemorrhage and/or microaneurysms (HMA), venous beading (VB), intraretinal microvascular abnormalities (IRMA), and new vessels elsewhere (NVE). Kappa (κ) and weighted κ statistic for agreement.

Results: The distribution of DR severity by ETDRS 7-standard field film photography was no DR 12.5%, nonproliferative DR mild 22.8%, moderate 30%, and severe/severe 8%, and proliferative DR 27%. Diabetic retinopathy severity between DGLC200 and ETDRS film photographs matched in 86% of eyes [weighted $\kappa = 0.74$ ($\kappa = 0.68$) and was within 1 level in 94.5% of eyes. DGLC200 and DFE matched in 98.8% of eyes [weighted $\kappa = 0.85$ ($\kappa = 0.47$) and were within 1 level in 91.2% of eyes. Forty eyes (20%) had DR severity discrepancies between DGLC200 and ETDRS film photographs. The retinal lesions causing discrepancies were IRMA 53%, IRMA 26%, NVE 17%, and VB 6%. Approximately one-third of HMA, IRMA, and NVE were predominantly outside ETDRS fields. Lesions identified on DGLC200 but not ETDRS film photographs suggested a more severe DR level in 10% of eyes. Distribution in the temporal, superotemporal, inferotemporal, superonasal, and inferonasal fields was 77%, 72%, 67%, 65%, and 88% for HMA, respectively ($P < 0.001$); 22%, 24%, 27%, 28%, and 22% for VB, respectively ($P = 0.026$); 52%, 40%, 29%, 27%, and 26% for IRMA, respectively ($P < 0.0001$); and 8%, 4%, 4%, 6%, and 6% for NVE, respectively ($P = 0.03$). All lesions were more frequent in the temporal fields compared with the nasal fields ($P < 0.0001$).

Conclusions: DGLC200 images had substantial agreement with ETDRS film photography and DFE in determining DR severity. On the basis of DGLC200 images, significant nonuniform distribution of DR lesions was evident across the retina. The additional peripheral lesions identified by DGLC200 in this cohort suggested a more severe assessment of DR in 10% of eyes that was suggested by the lesions within the ETDRS fields. However, the implications of peripheral lesions on DR progression within a specific ETDRS severity level over time are unclear and need to be evaluated prospectively.

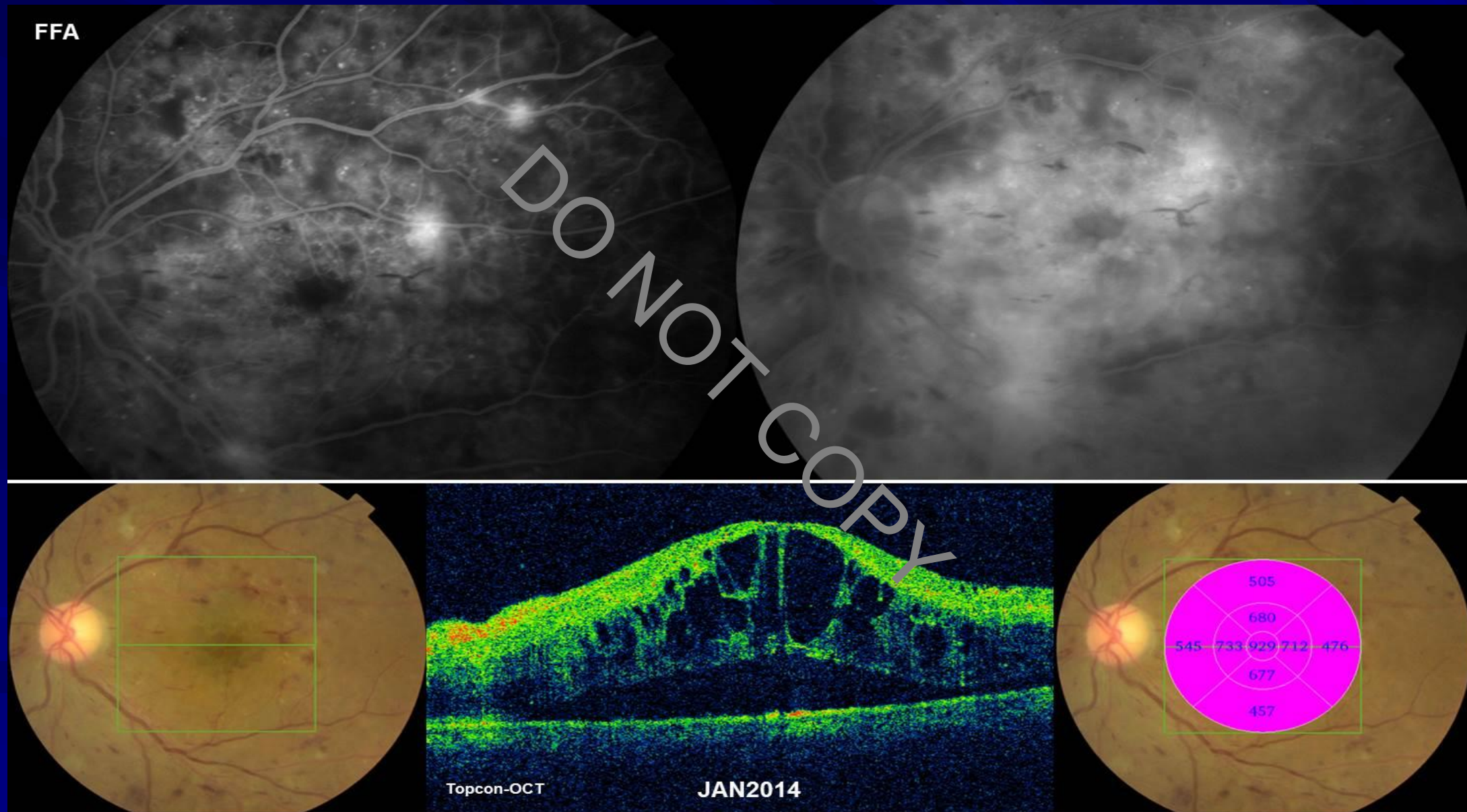
Financial Disclosure: Proprietary or commercial disclosure may be found after the references. Ophthalmology 2013;121:e1-e10 © 2013 by the American Academy of Ophthalmology.



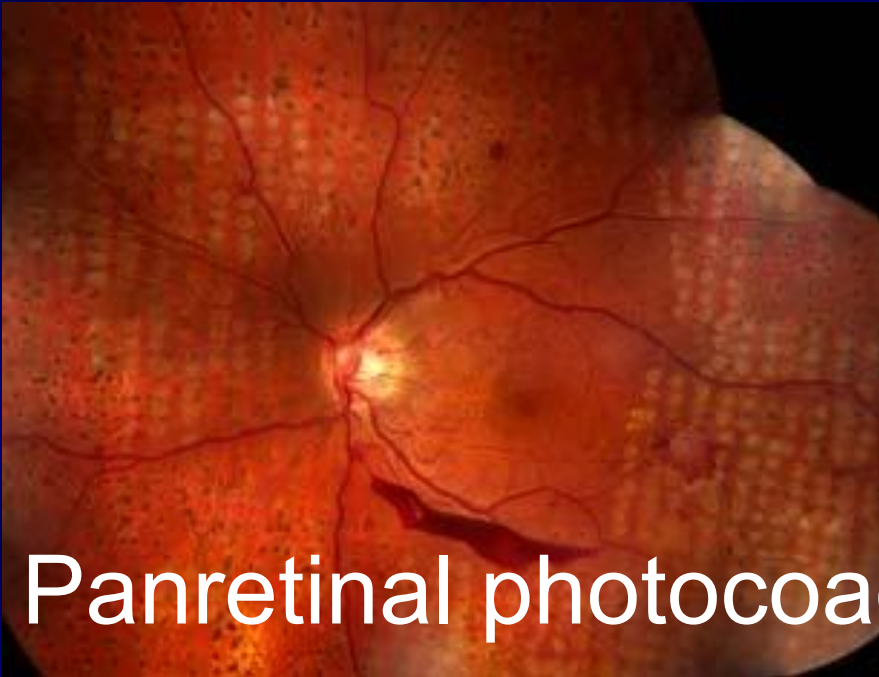
Management of diabetic eye disease is guided by landmark clinical trials conducted during the past 40 years.¹⁻¹⁰ These clinical trials established treatment modalities and sched-

mydriatic, stereoscopic, 30-degree, 35-mm, initial photog-
raphy obtained using a defined protocol of 7 standard retinal
fields in which a reference is referred to as "Early Treatment Diabetic

Proliferative disease and DMO



Who to treat and what to use?



Panretinal photocoagulation



Injection into the eye

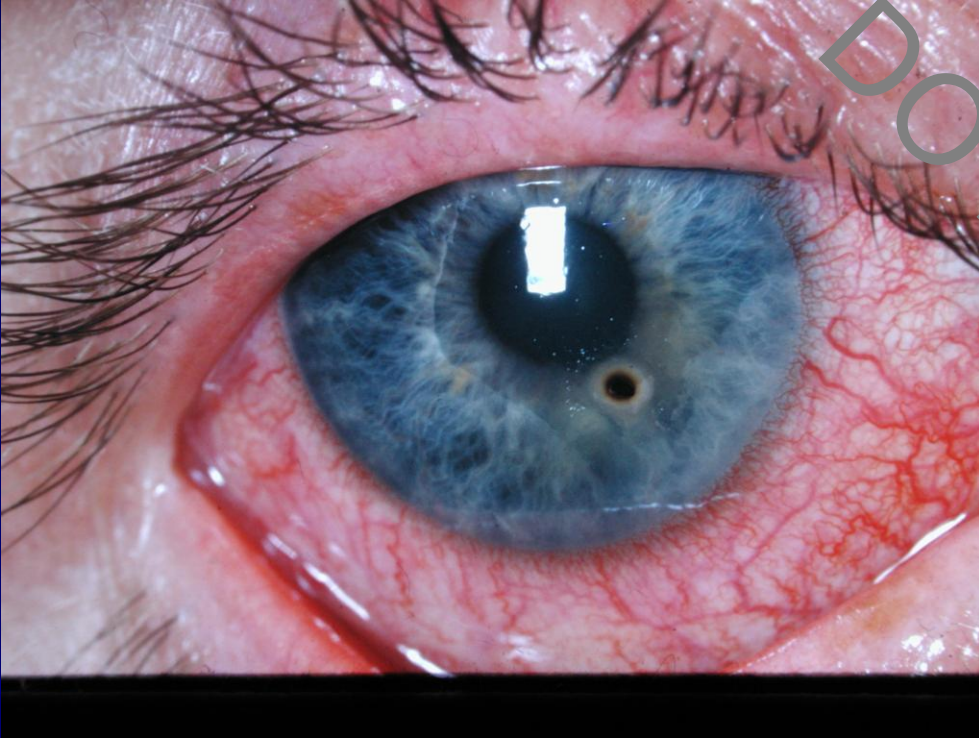


We need safe long term treatment options for earlier disease

Early clinical trials

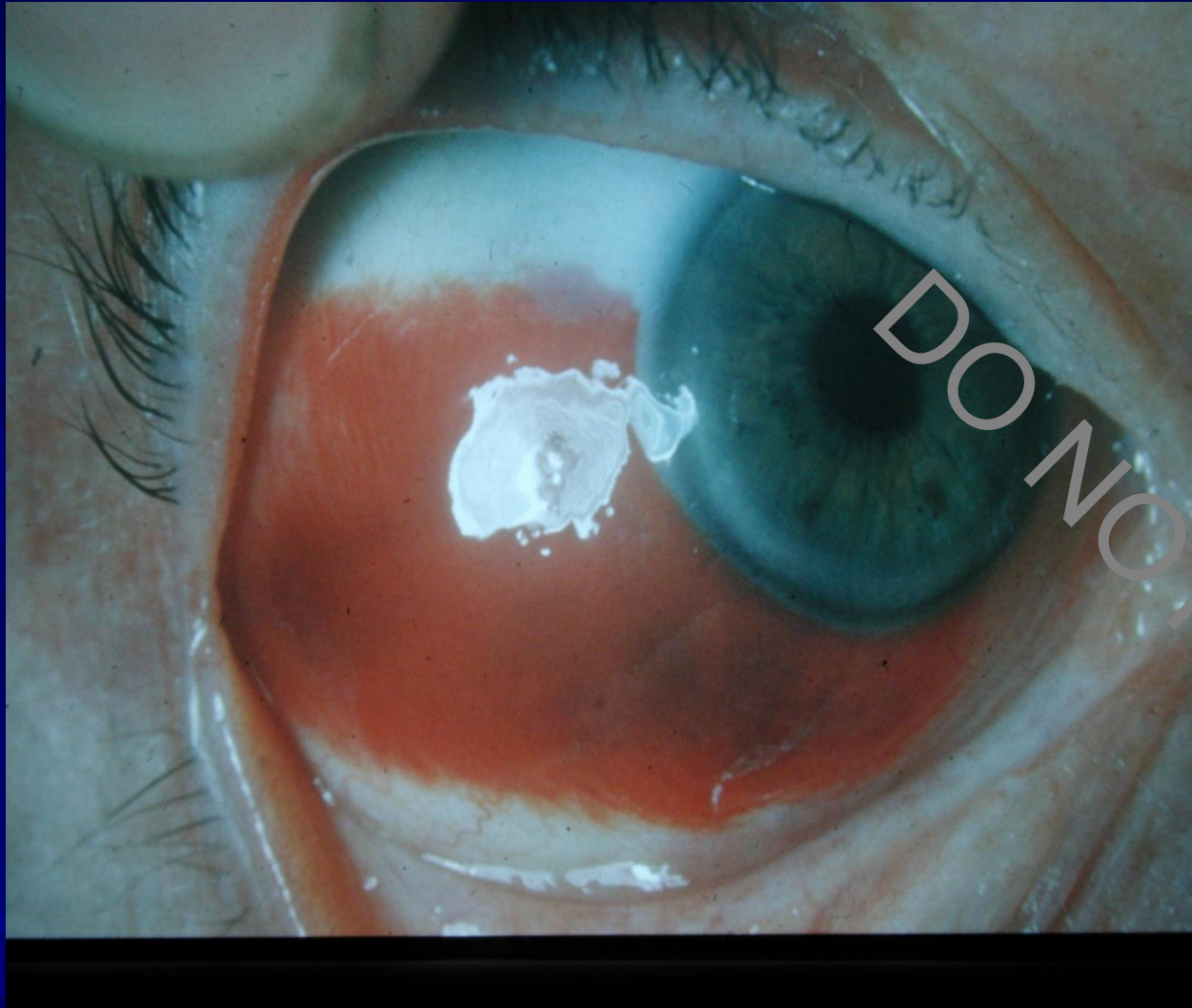
- DRS and ETDRS – proved that laser provides long-term stability and prevents 90% of visual loss in PDR and established the fundamentals of imaging and image analysis in DR/DMO
- UKPDS and DCCT – proved that systemic control of diabetes has a significant impact on diabetic eye disease
- Early worsening phenomenon was present in these studies as well – so insulin pump, GLP-1s etc just replicate this!

Dry eye and corneal nerve damage are common



There is a corneal foreign body, patient did not feel its presence and only came to clinic when the eye was red and the family noticed the redness.

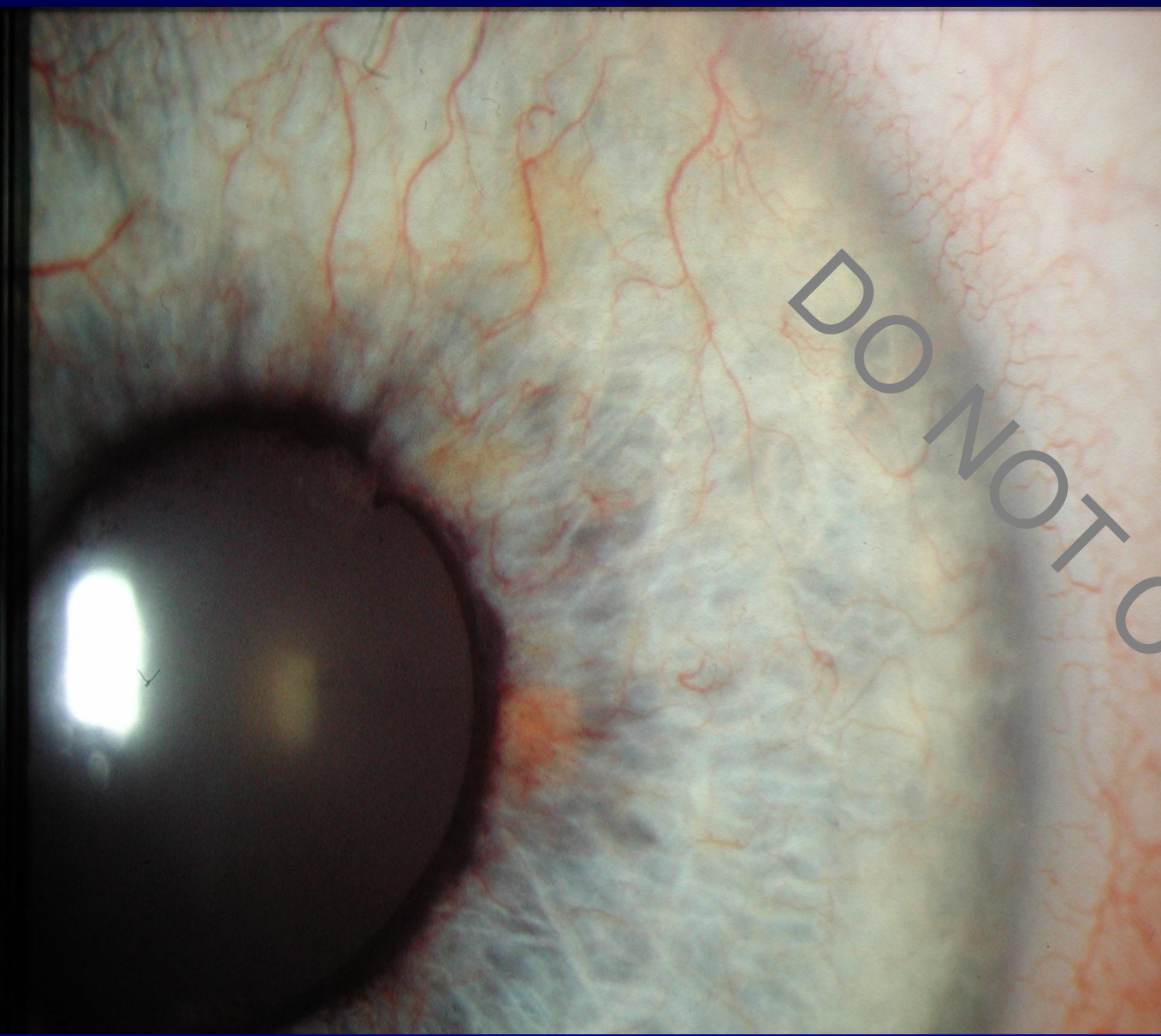
Recurrent corneal erosion syndrome can occur after any injury.



Conjunctival haemorrhage is common in diabetes, combination of dry eye and brittle vessels.



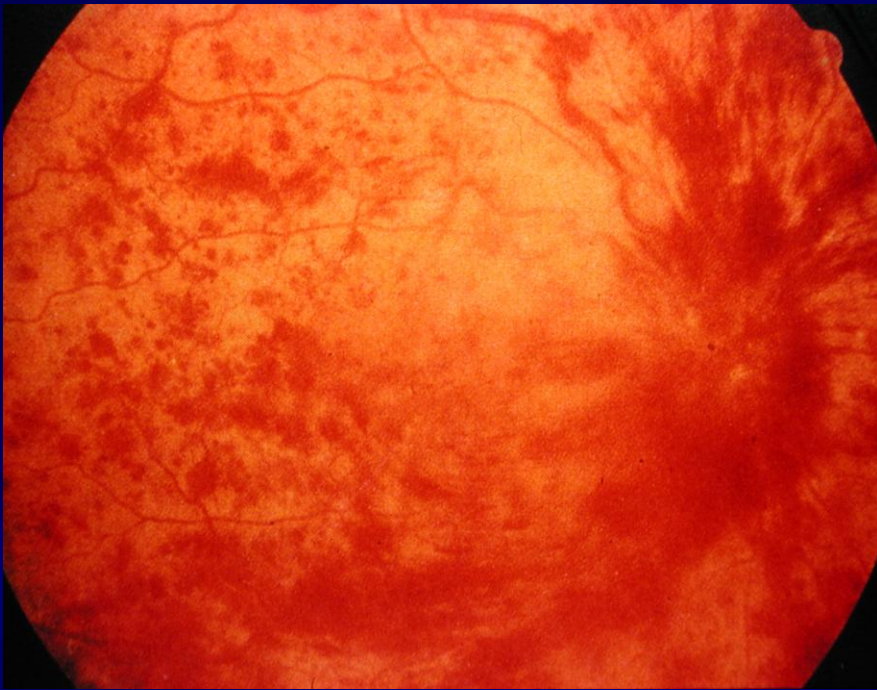
Conjunctivitis can occur more frequently and can be hard to treat.



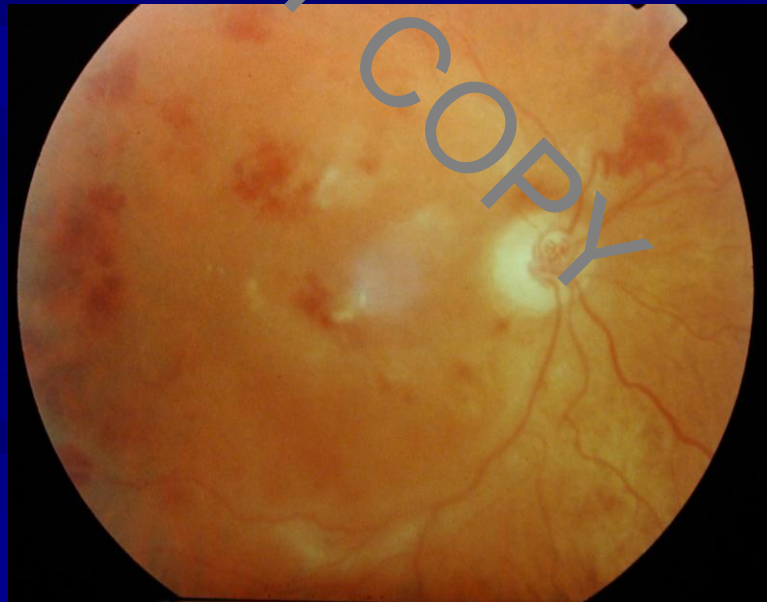
Iris neovascularisation

If left untreated, it can result in neovascular glaucoma, loss of vision and painful, red eye

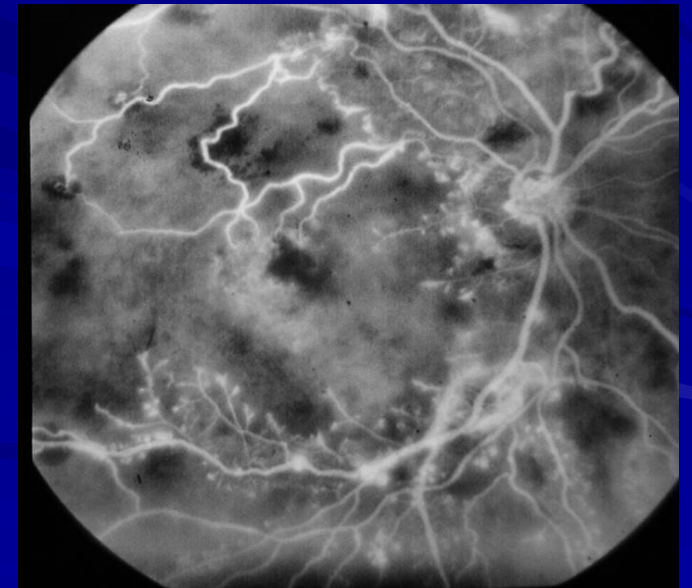
Central retinal vein occlusion

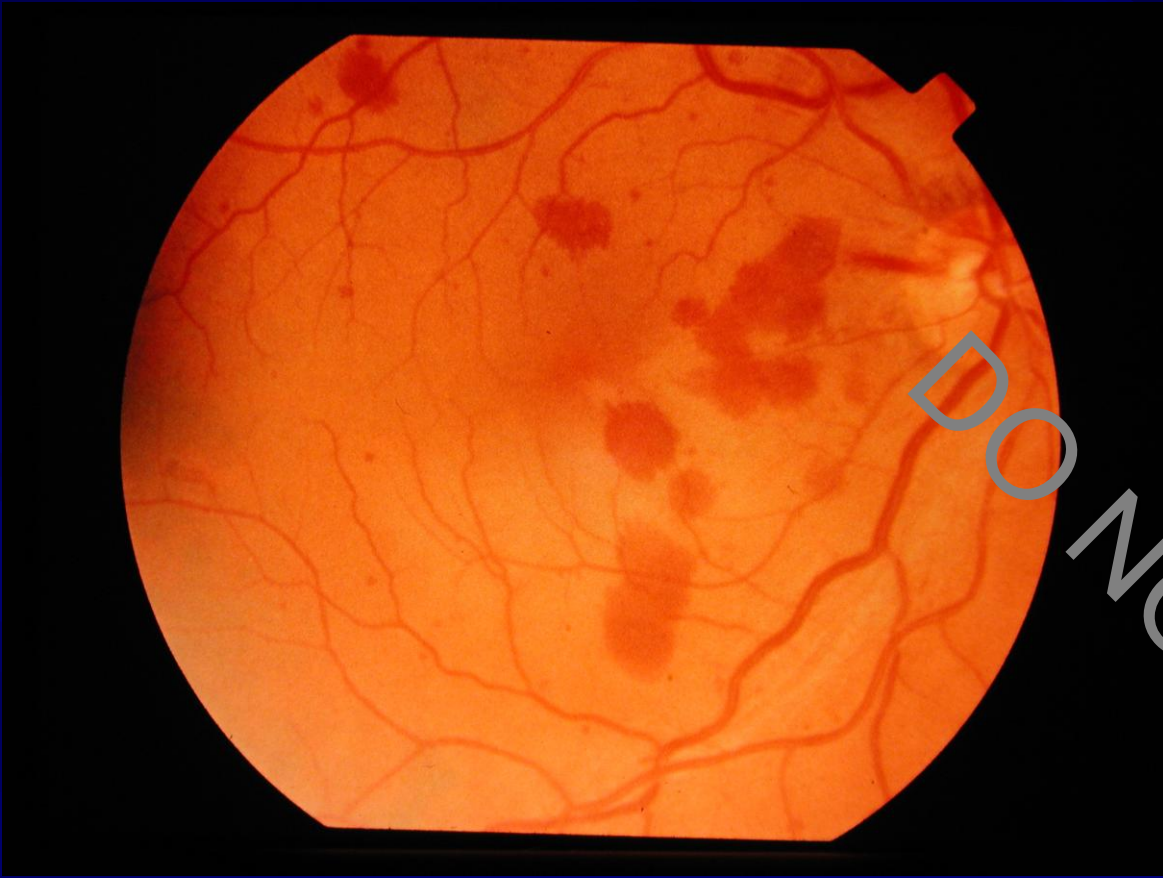


Non-ischaemic –
Usually good vision
Usually younger patient



Ischaemic – poor vision



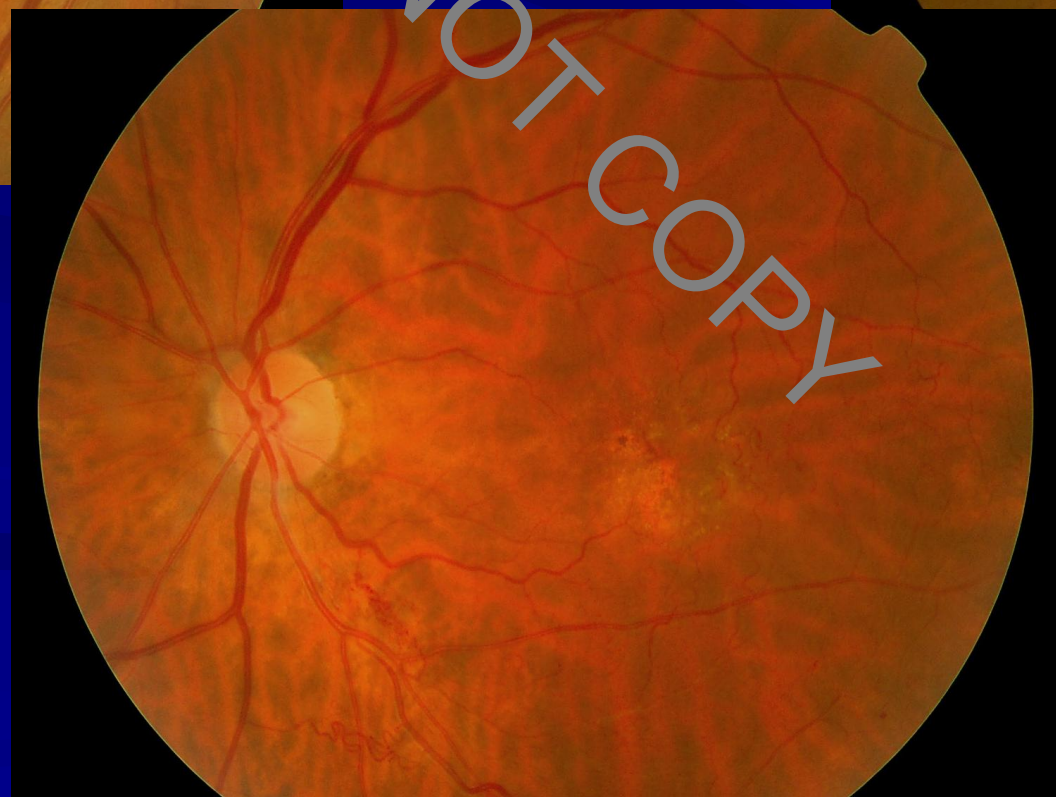


Combined with Branch or Central
Retinal Artery occlusion: cherry red spot
with white macula – usually poor
outcome



Branch retinal vein occlusion

- A cause should be found for it!
- Most common caused: diabetes mellitus, hypertension and lipid abnormalities
- Investigations need to be done by the referring physician
- Many patients are found to have asymptomatic old BRVO-s in screening setting

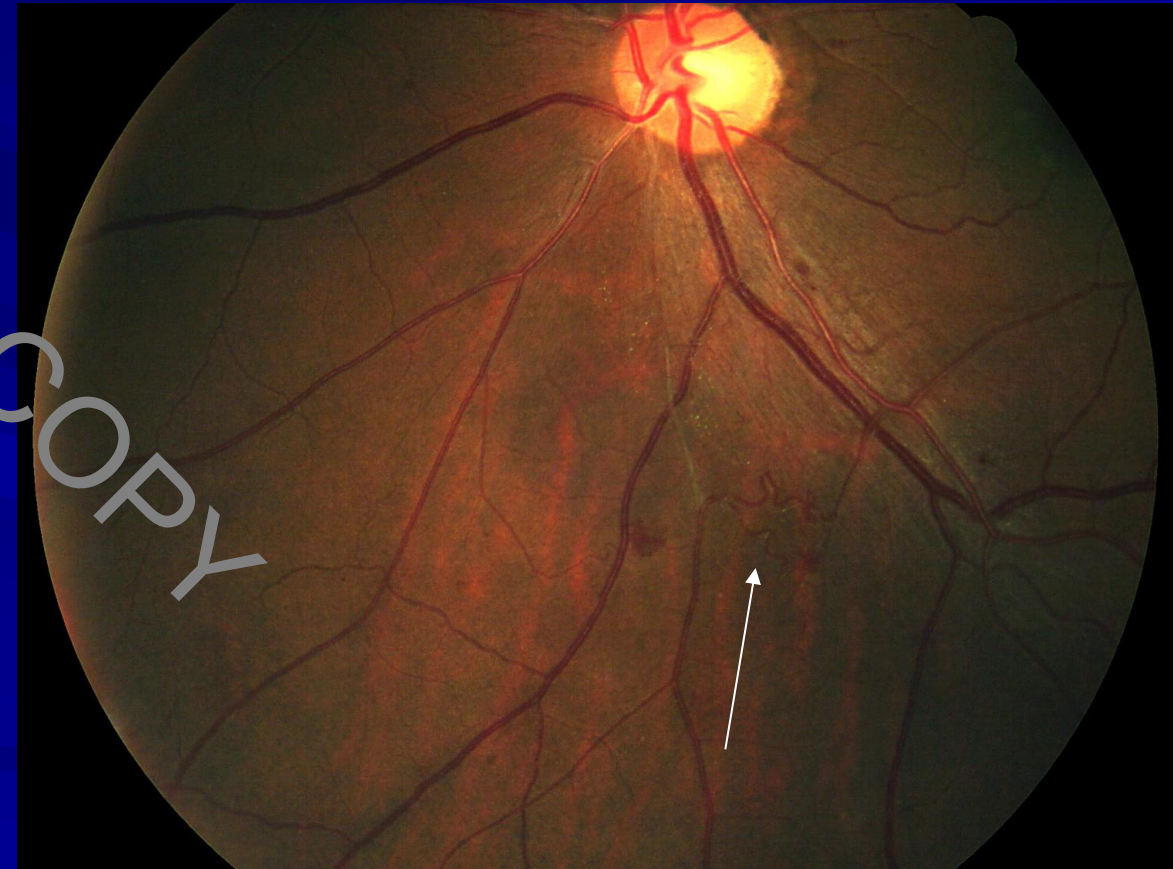


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Collaterals after artery occlusion



Embolic disease: local protocol, but requires GP notification so risk factors for stroke and sight threatening disease can be addressed



Signs and symptoms

- Diabetic retinopathy and maculopathy give no signs or symptoms until very late in the disease, hence screening and early detection is so important. If there is diabetic eye screening available, best to encourage attendance.
- Once visual loss occur, usually there is little improvement even with treatment, but preserving the remaining vision is the aim for many patients.
- Sudden visual loss most commonly caused by vitreous or pre-retinal haemorrhage, retinal detachment, artery or vein occlusion.

Other visual issues

- Diplopia (double vision) is not uncommon due to nerve palsies, all must be investigated at the outset.
- Patients usually are unaware that their colour vision can be affected with diabetes and/or cataract.
- Dark adaptation and visual fields might be affected if the peripheral retina is very ischaemic, and/or with laser treatment, so they might have cuts and bruises due to bumping into things.

And what the patients are worried about: Trips and falls: the dangers of attending clinic appointments, going shopping



Parked Cars on Pavements



Bollards



Street Clutter



A-Boards and Al Fresco Dining



Shared Space



Tree Roots and uneven/constant paving design



Unfinished/Damaged paving



Long term goal is to understand diabetes and diabetic eye disease
so every patient is in the appropriate clinical pathway based on
relevant clinical and clinical trials data

