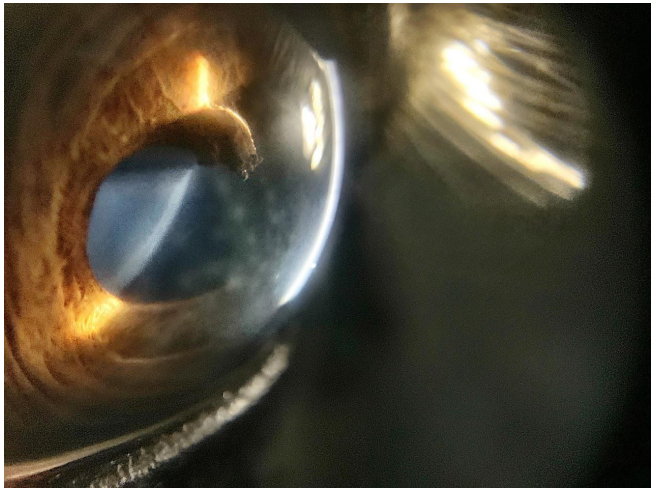
Imaging the anterior segment – pt 1, the cornea.



Trigger's story

Focal refractive change at edge of superficial ulcer.

Central area of shadowing – is this an opacity?

Corneal infiltrate?

Foreign body?

Distant direct –iPhone XSM, digital zoom from 30cm.

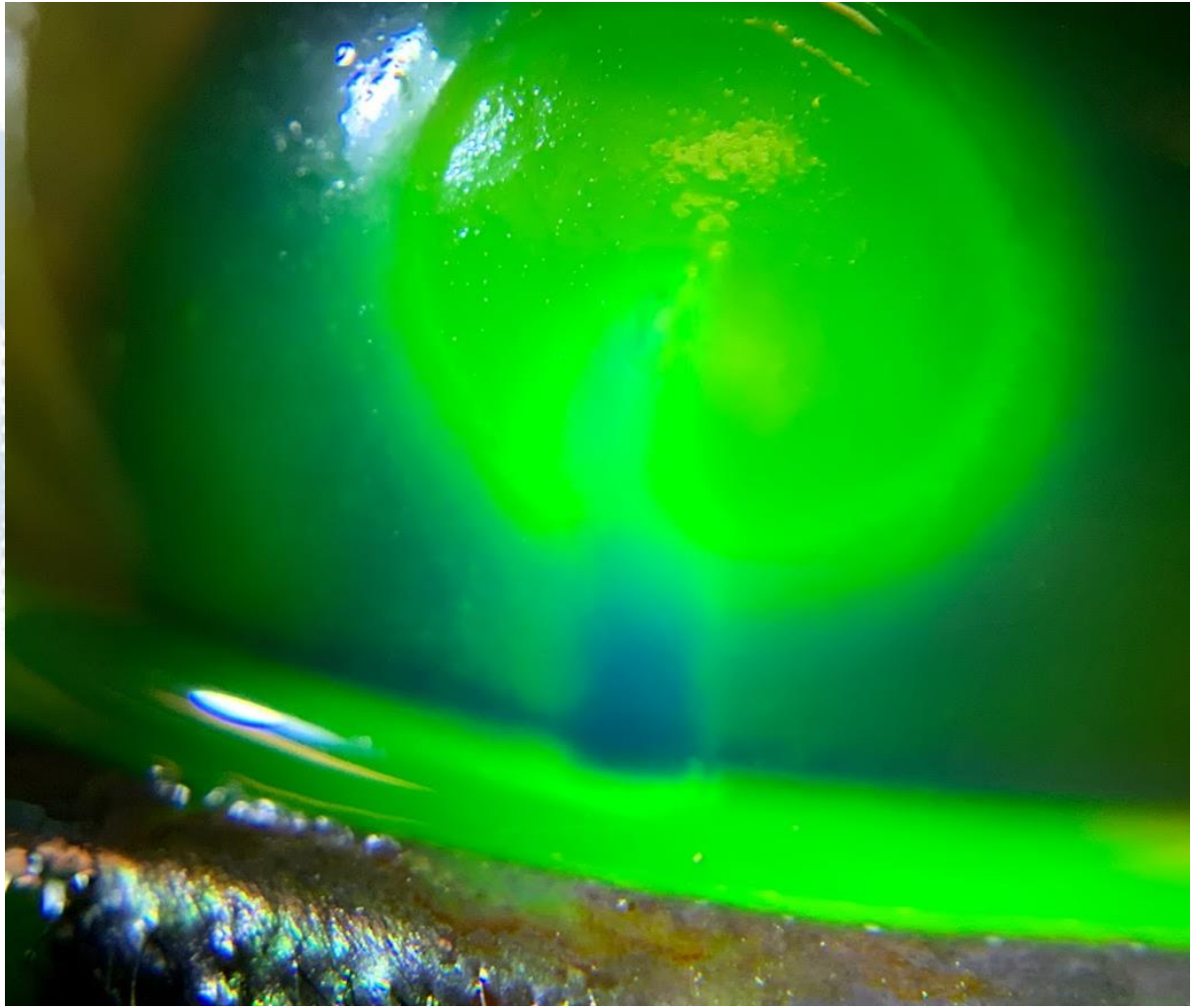
Trigger's story

Under-run epithelium

Leaking?

Foreign body?

Macro photograph, iPhone XSM and x10 lens Oblique handheld lighting



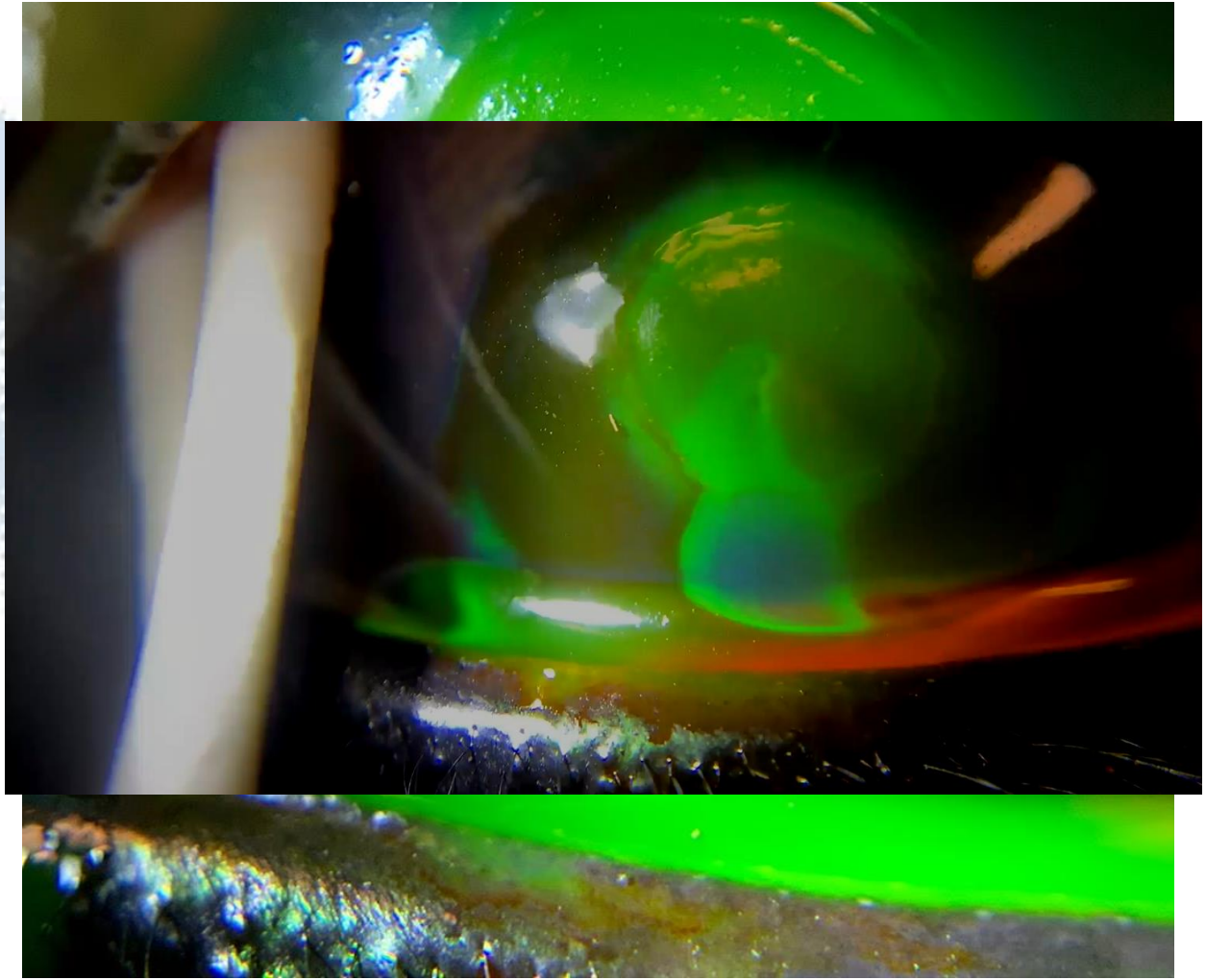
Trigger's story

Under-run epithelium

Leaking?

Foreign body?

Oblique handheld lighting
Video, iPhone XSM



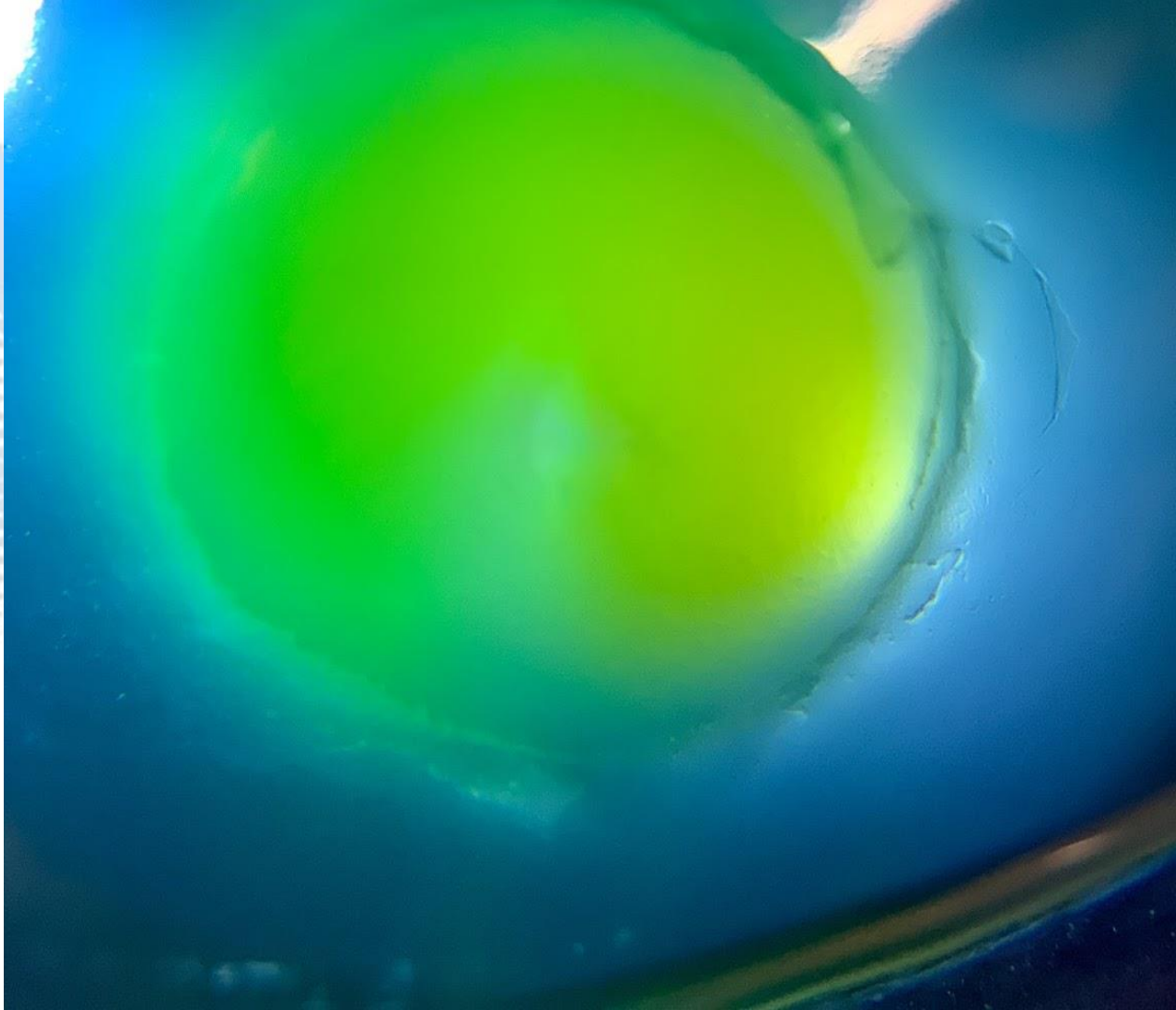
Trigger’s story

Under-run epithelium

Leaking?

Foreign body?

Macrophotograph, iPhone XSM and x10 lens, retro illumination



Trigger's story

In clinic monitoring.

iPhone SE, distant direct image, digital zoom and "torch mode"

Distant direct phoneoscopy

In the year 2 BS (2008)

“Before Smartphones”

Using fundic reflections to highlight required a small light to lens distance achievable only using :

- Ring flashes
- Compact cameras
- Distance

Canon ixus 95

Distant direct phoneoscopy

- Mimics distant direct ophthalmoscopy
- “Arms length” (30cm)
- Defocussed fundic reflection highlights opacities and changes in refraction

I. Torch mode on
II. Position as far away from eye as can and still see the screen (remember your reading glasses!)
III. Digital zoom to get pupil to fill screen
IV. Move around to see outside the visual axis
V. Repeat at camera’s minimum focal distance to document pathology

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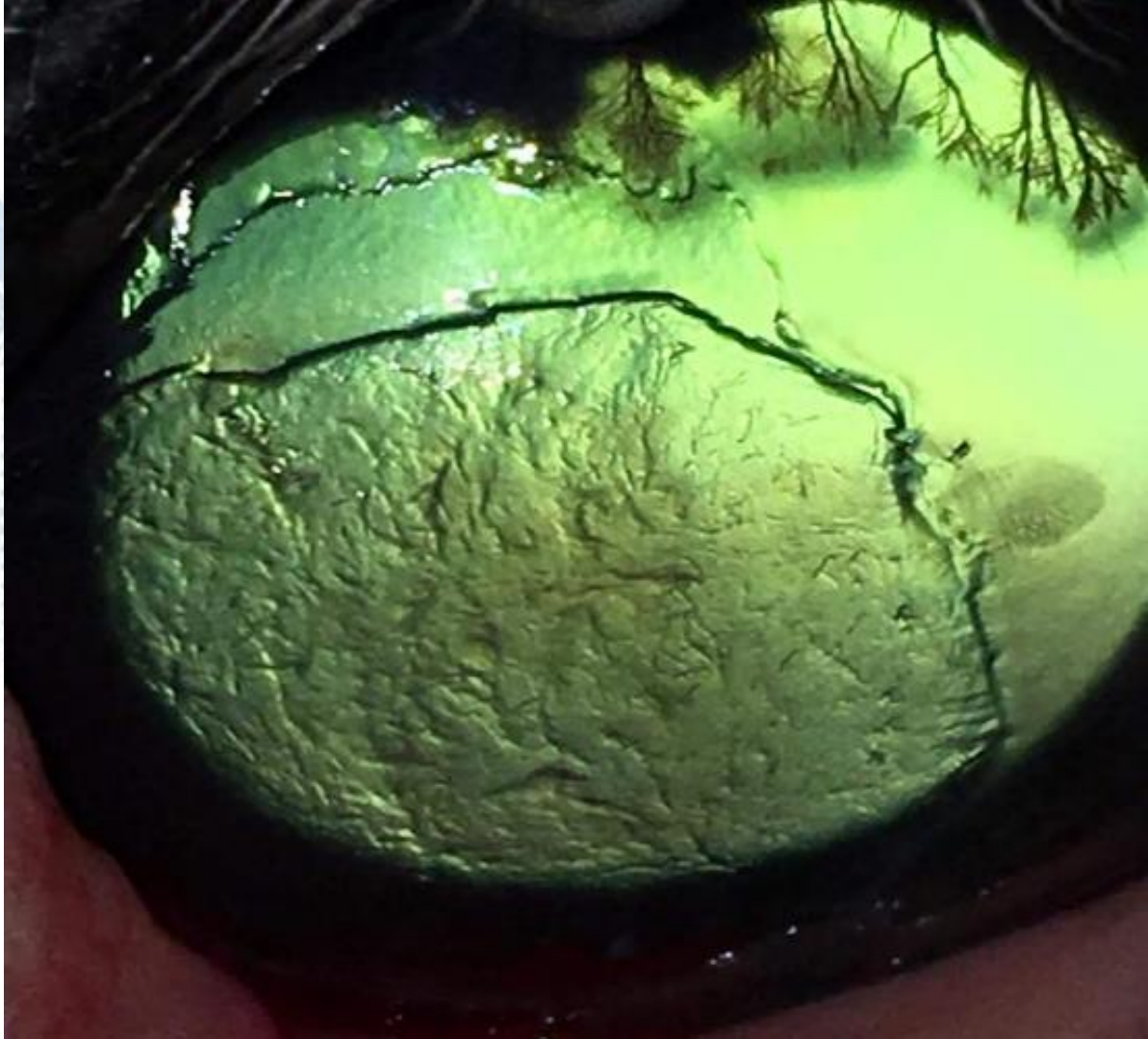
Distant direct phoneoscopy

- Mimics distant direct ophthalmoscopy
- “Arms length” (30cm)
- Defocussed fundic reflection highlights opacities and changes in refraction

- If light intensity low enough refractive changes will appear as shadows



Distant direct phoneoscopy

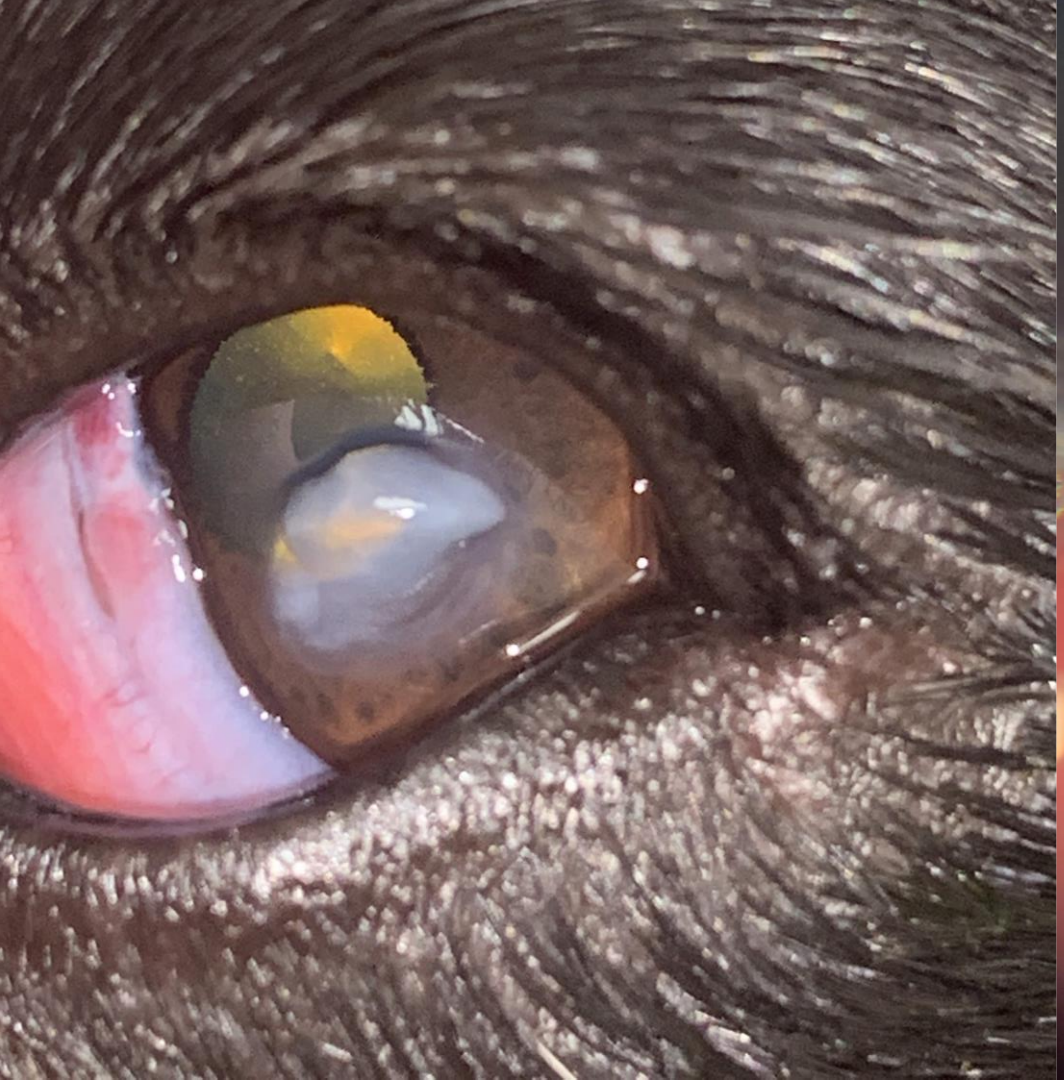
- Mimics distant direct ophthalmoscopy
- “Arms length” (30cm)
- Defocussed fundic reflection highlights opacities and changes in refraction
- Increased incident lighting changes appearance of edge of ulcer but not the opaque blood vessels
- Adding oblique lighting can add more information

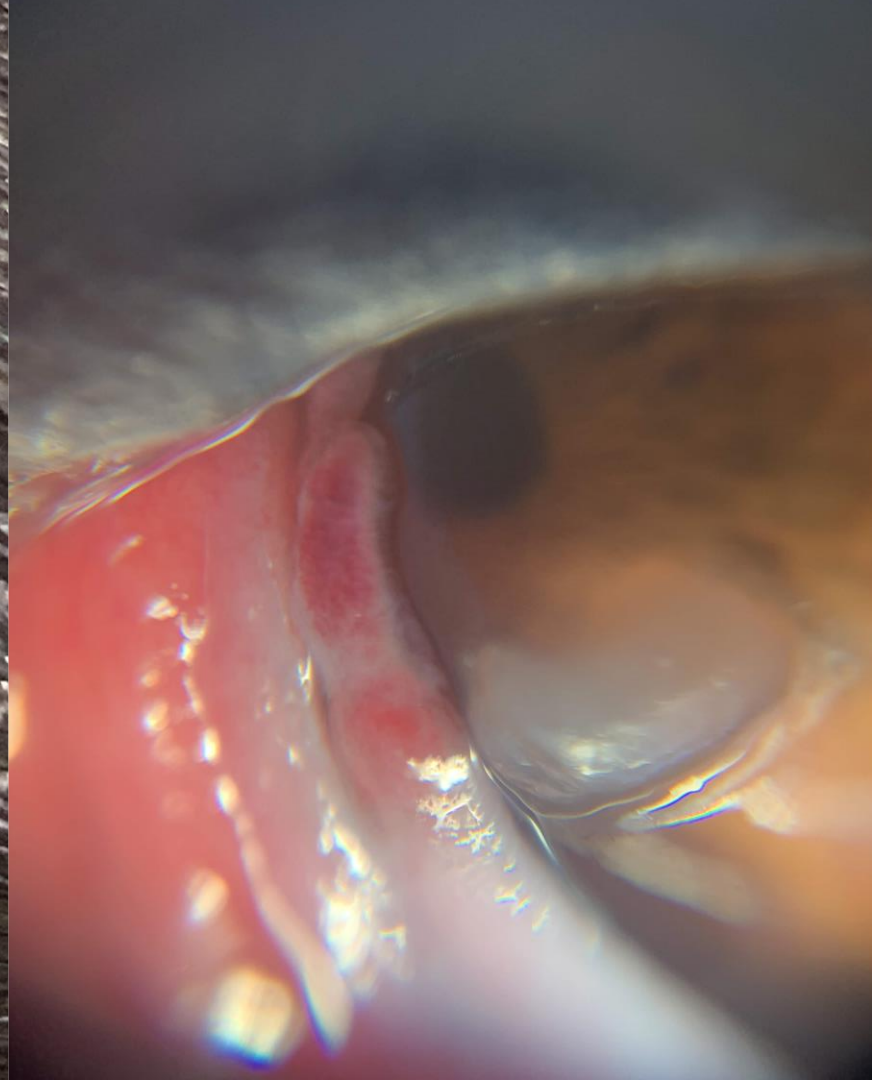
Smartphone Macrophotography

Macro lens

Look for:

- Black
- Case fitted lens?
- Magnification x10 fine
- x20 can be helpful
- Coated glass lenses ideal
- Small (light to lens distance?)





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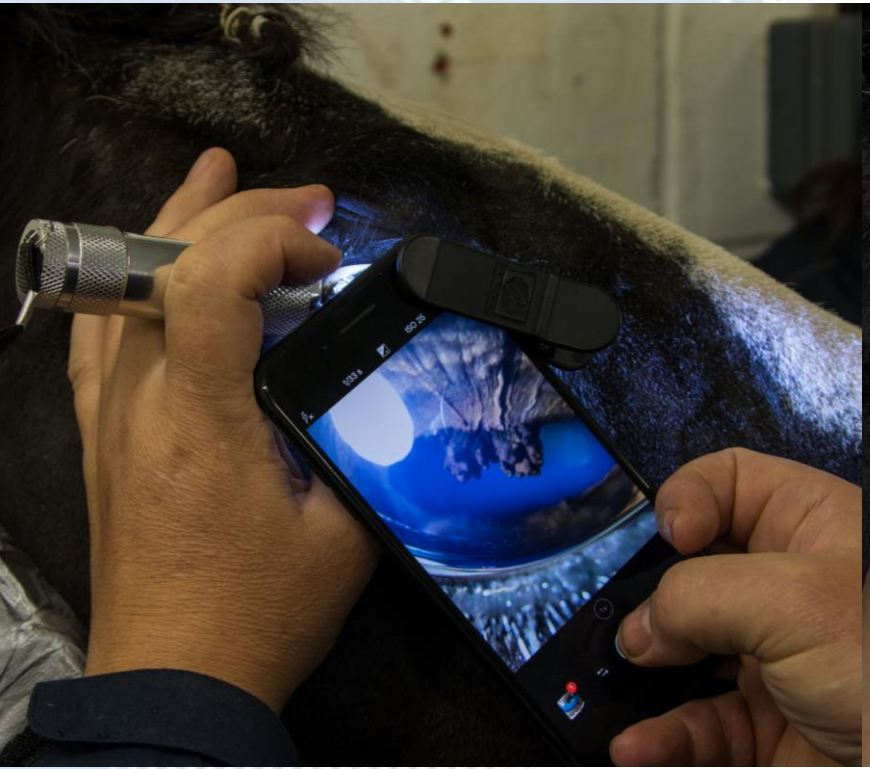
- x20 can be helpful
- Coated glass lenses ideal
- Small (light to lens distance?)

- iPod touch vs iPhone 7+

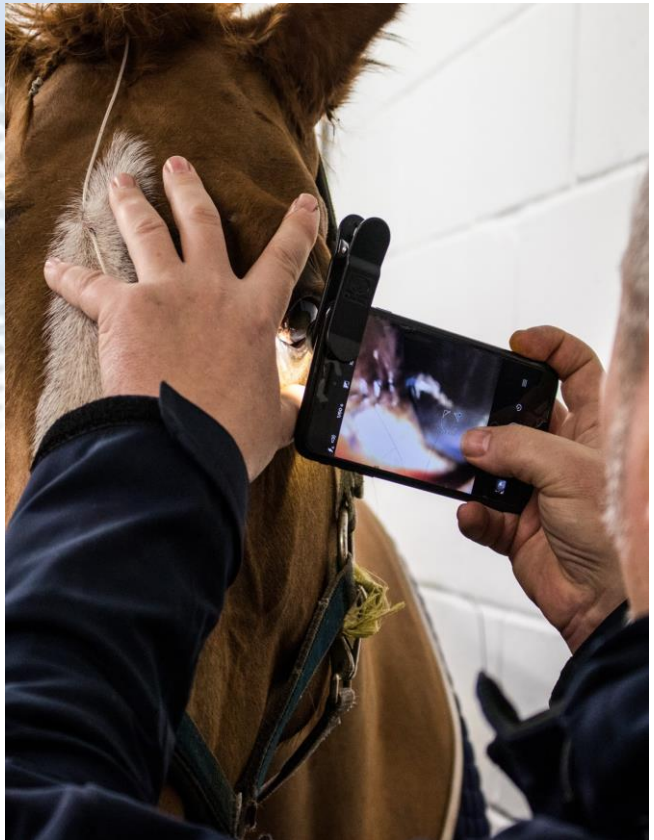
MACRO

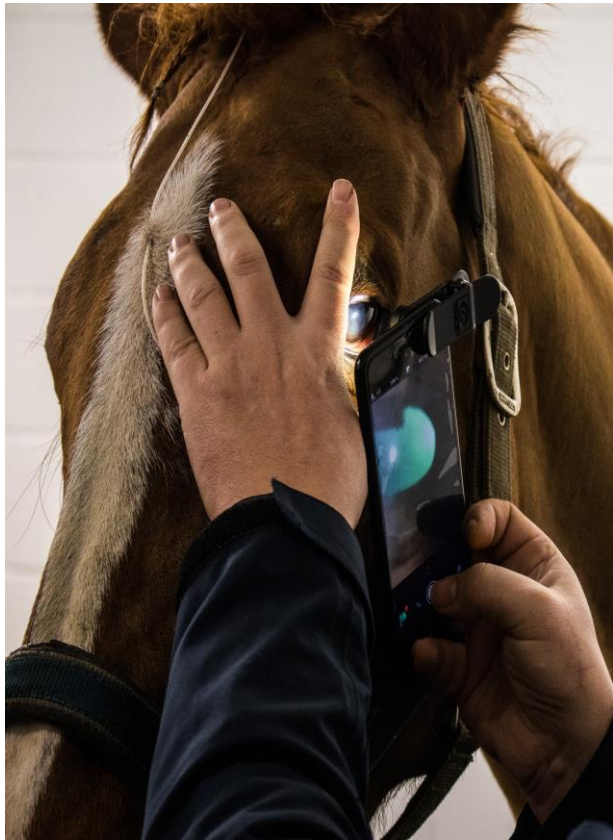
modelling lights vs on-phone light



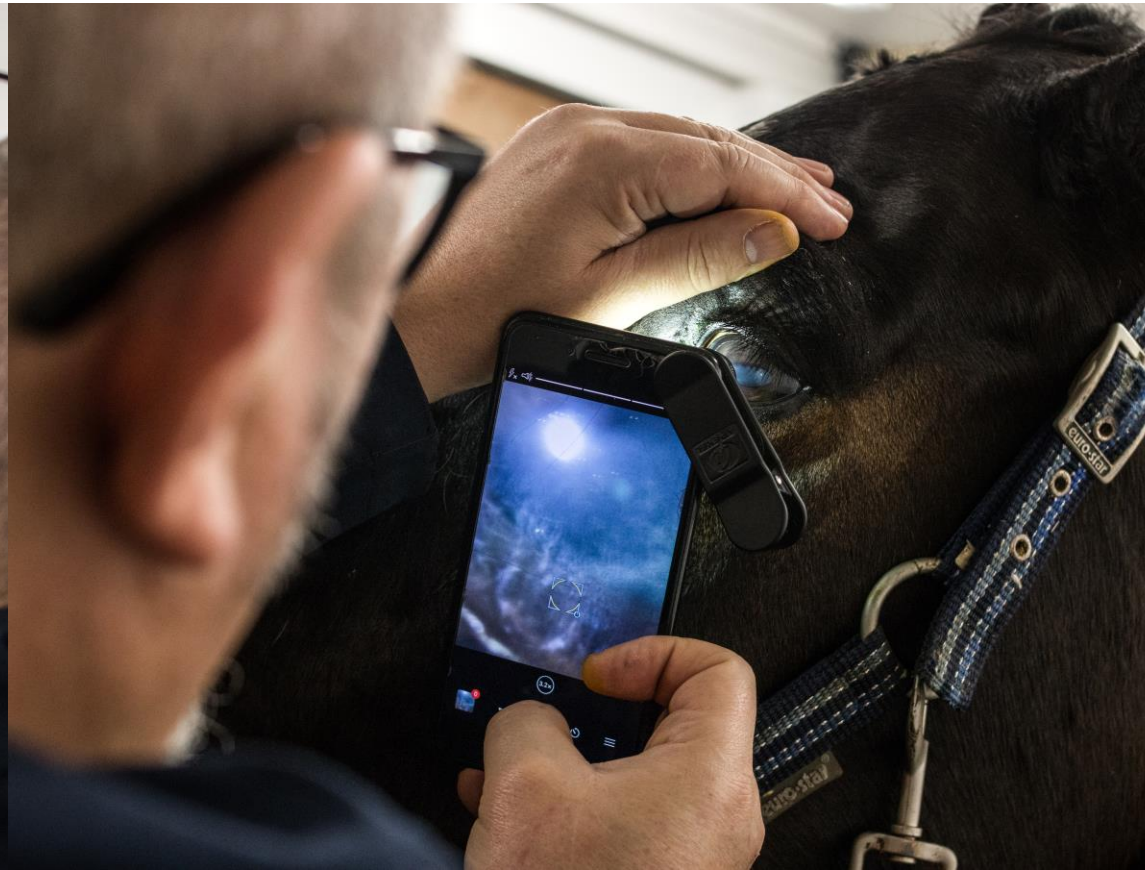
focus with micromovements

Creative holding techniques



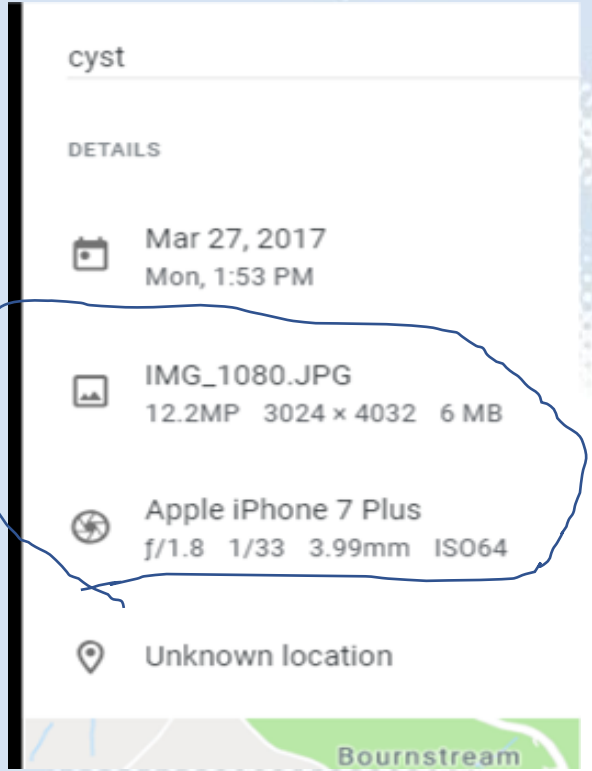


Use digital zoom



Improving your macro-photoraphy

EXIF data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DETAILS
Mar 27, 2017
Mon, 1:53 PM
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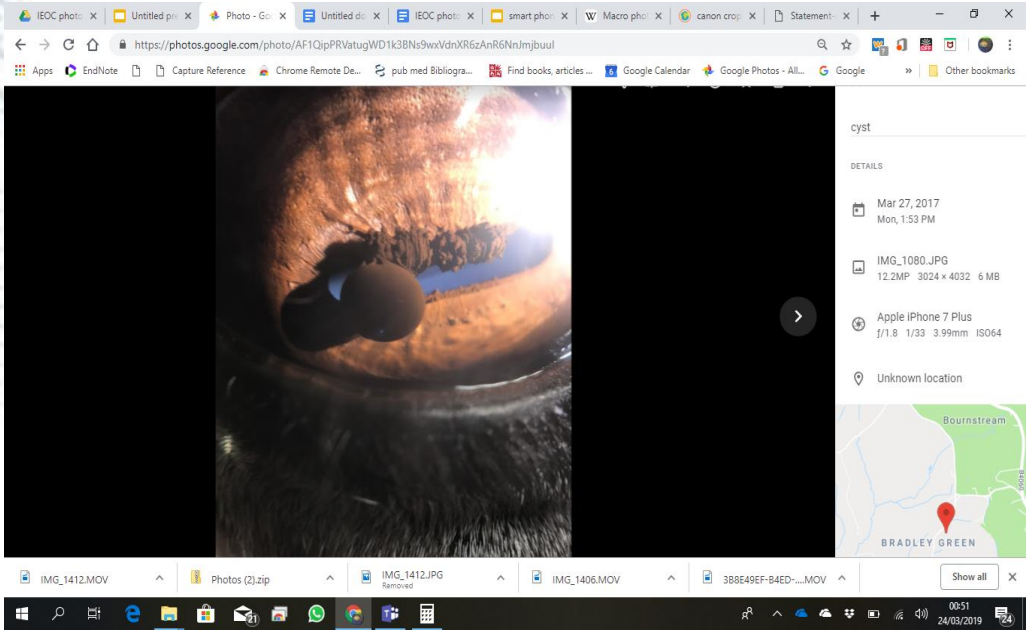
12.2MP 3024 × 4032 6 MB
Apple iPhone 7 Plus
ƒ/1.8 1/33 3.99mm ISO64
Unknown location
Bournstream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cyst
DETAILS
Mar 27, 2017
Mon, 1:53 PM
IMG_1080.JPG
12.2MP 3024 × 4032 6 MB
Apple iPhone 7 Plus
ƒ/1.8 1/33 3.99mm ISO64
Unknown location
Bournstream
BRADLEY GREEN
IMG_1412.MOV
Photos (2).zip
IMG_1412.JPG
IMG_1406.MOV
Show all

Macrophotography

Apple iPhone XS Max

ƒ/2.4 1/256 6mm ISO16

X10 macro lens, modelling light

Flesh fly (Sarcophaginae spp.)

Macrophotography

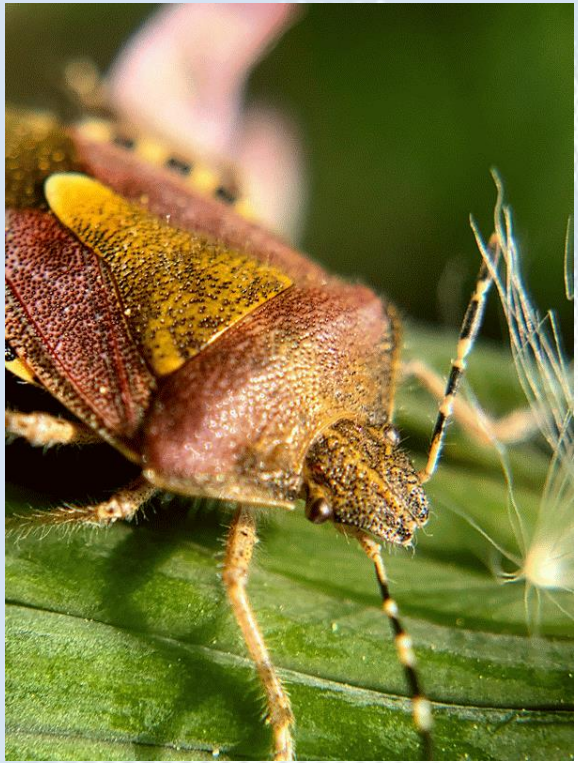
Apple iPhone XS Max

ƒ/2.4 1/122 6mm ISO25

X10 macro lens

Cucumber green spider (Araniella cucurbitina)

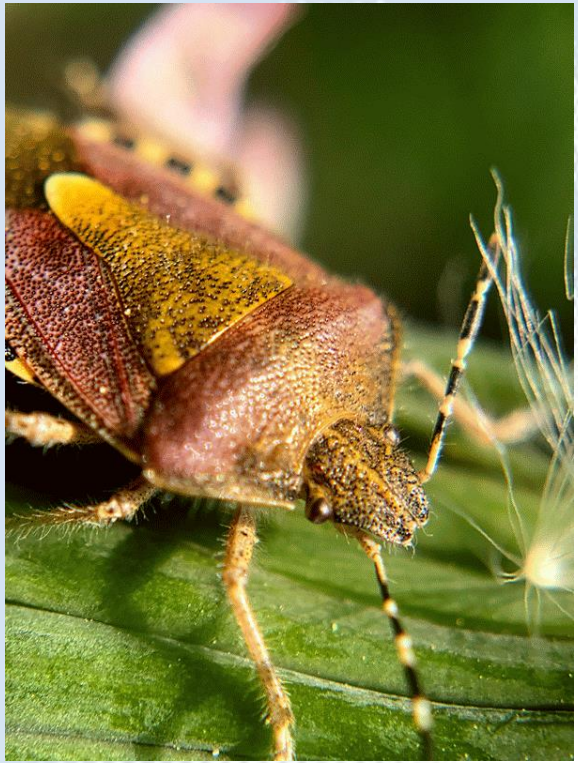
Macrophotography



Apple iPhone XS Max,
ƒ/2.4 1/122 6mm ISO25,
X10 macro lens

Shield bug
(*Acanthosomatidae spp.)*

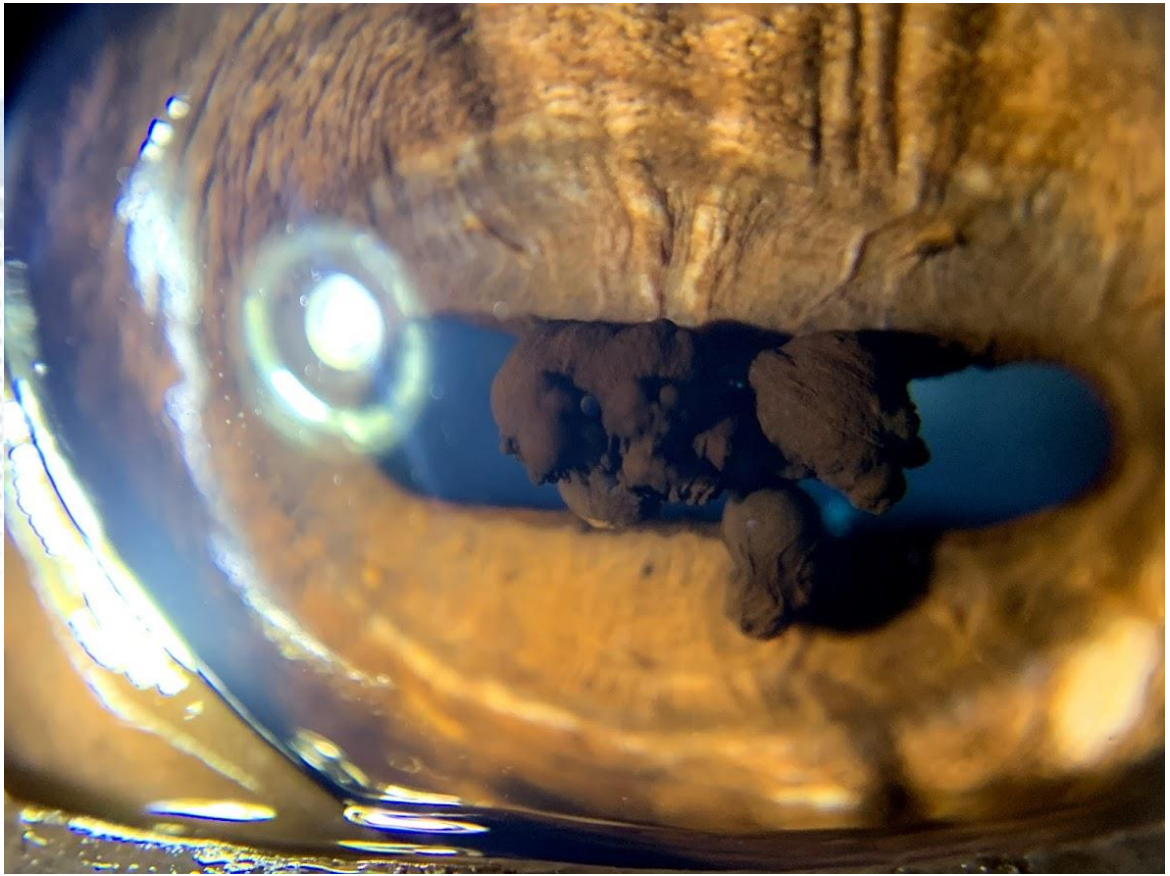
Macrophotography



critique

12.2MP 4032 × 3024 6.7 MB
f/1.8 1/50 4.25mm ISO100

- Light sufficient (ISO 100)
- Light angle highlights anatomy
- Focussed middle of granula iridica



iPhone XS Max, x10 macro & modelling light

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- Focussed middle of granula iridica

iPhone XS Max, x10 macro & modelling light

Focus - DOF

12.2MP 4032 × 3024 7 MB
f/1.8 1/50 4.25mm ISO125

- Light close, good intensity
- Direction light allows nice shadowing of iris architecture, PPMs & ventral cyst.
- Focussed at iris

iPhone XS Max, x10 macro & modelling light

Exposure - ISO

12.2MP 4032 × 3024 6.8 MB
*f/2.4 1/30 6mm **ISO1000***

- Light direction good
- Shadowed by lid reducing light intensity

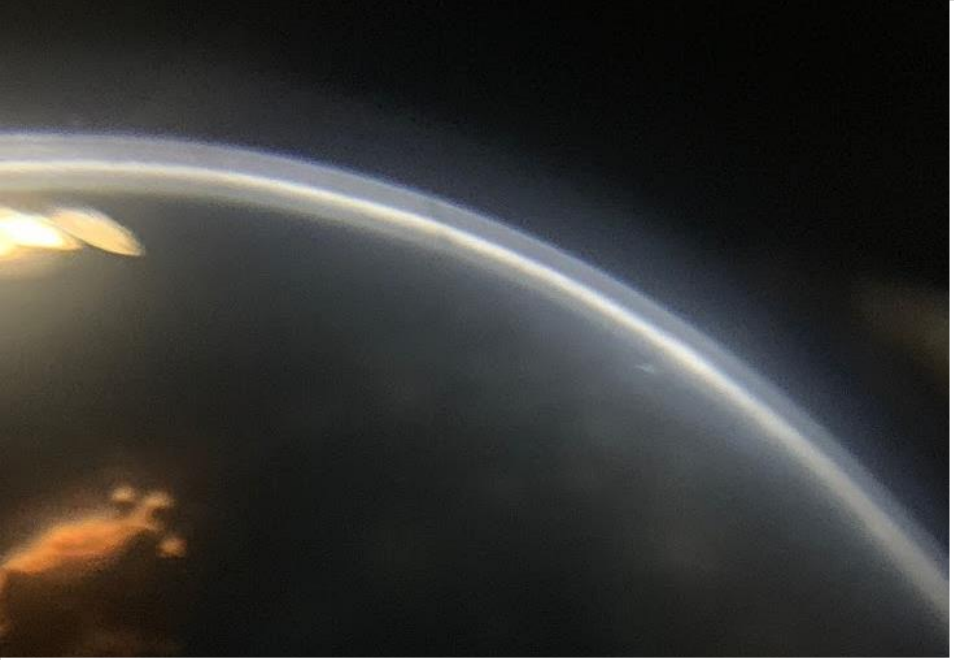
iPhone XS Max, x10 macro & modelling light

Modelling light

12.2MP 4032 × 3024 6.6 MB
ƒ/1.8 1/50 4.25mm ISO80

Corneal reflection obscures detail

iPhone XS Max, x10 macro & modelling light



Imaging the cornea

Photography as a clinical tool:

Questions

Reflectance

Transparency

Visual axis Significance

Depth

Curvature

Profile

Techniques

“Distant direct” and “close distant direct “

Using a macro lens

Oblique lighting

Retro illumination

Camera angle

Photography as a clinical tool:

Questions

Reflectance

Transparency

Visual axis Significance

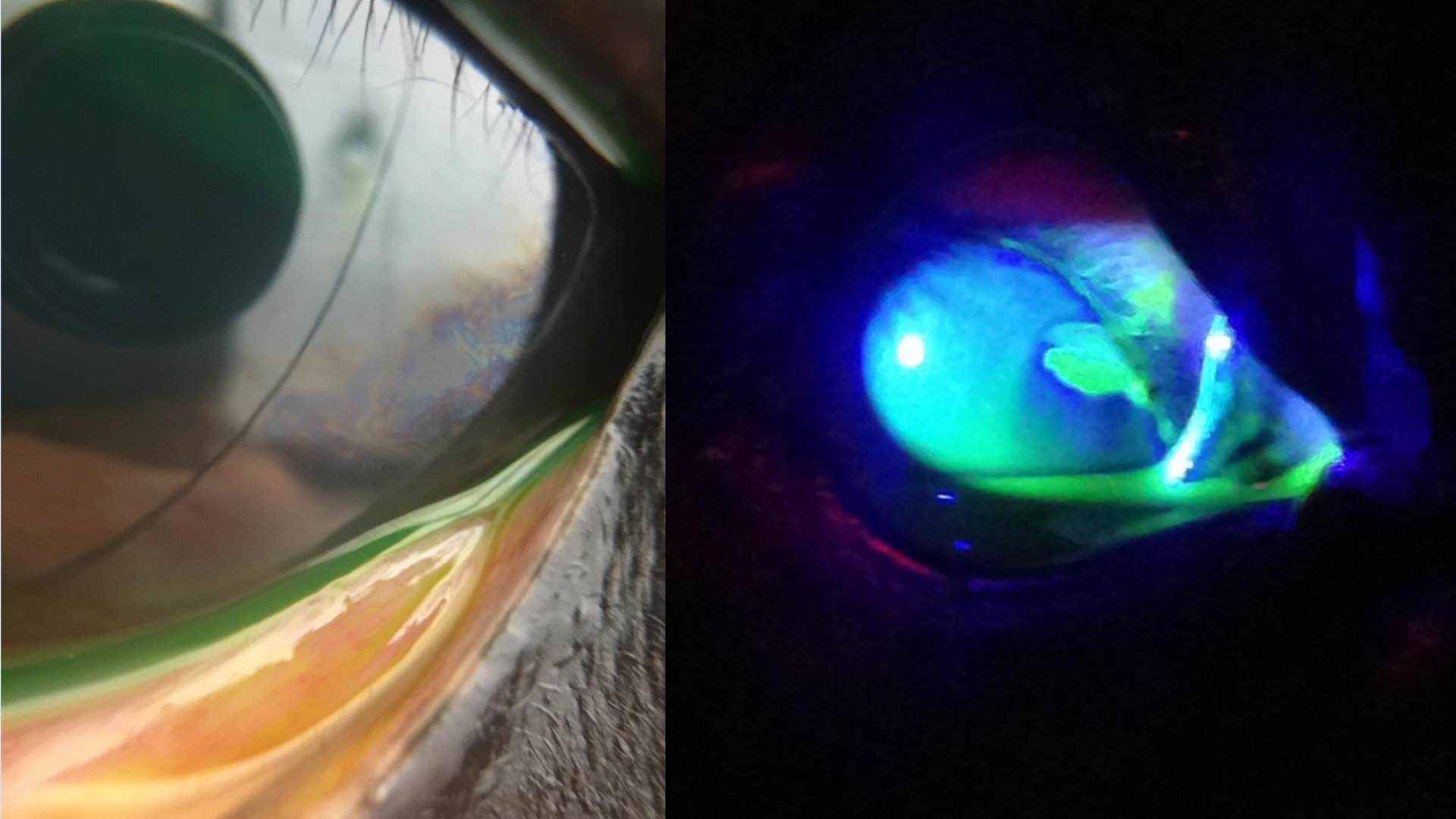
Depth

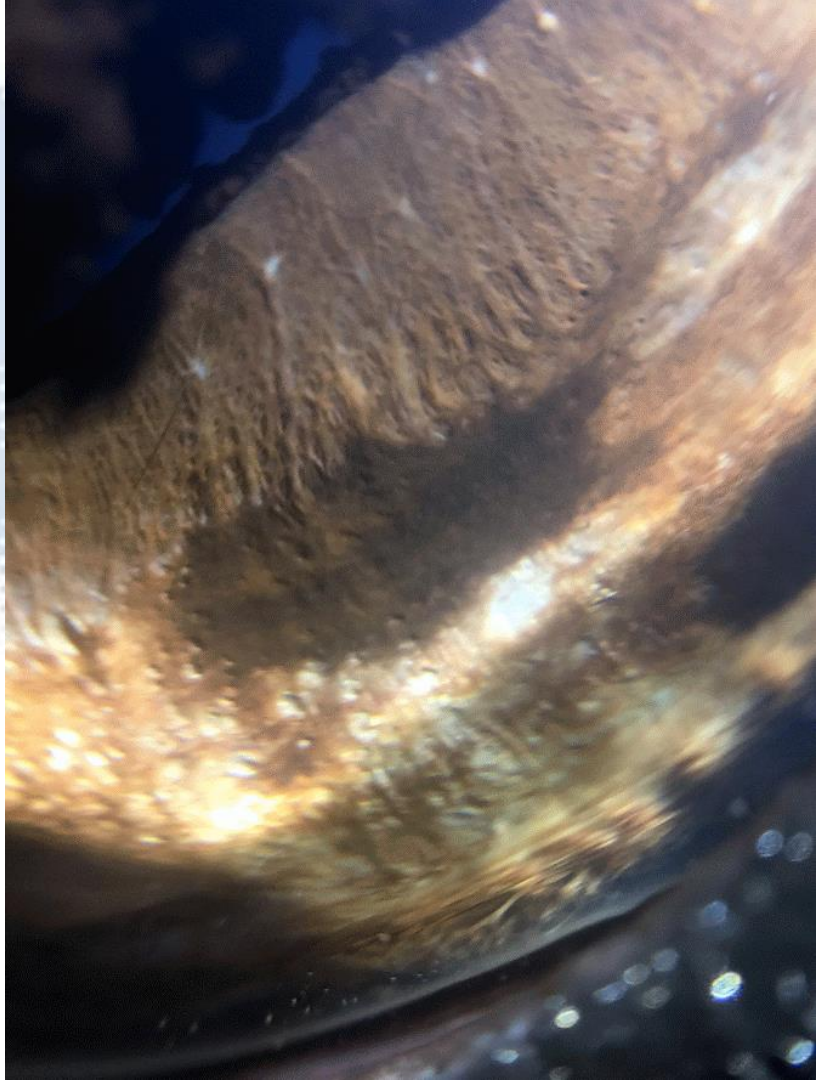
Curvature

Profile

Lesions

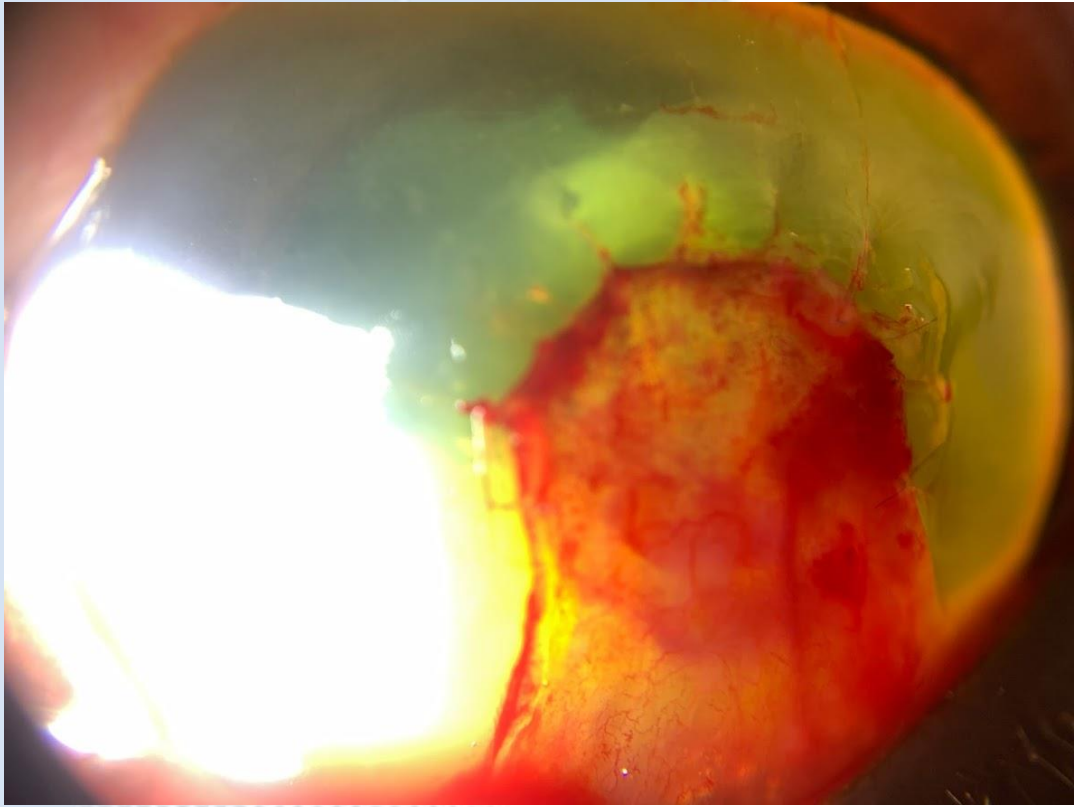
Deep ulcers - it’s all about the angles
Stromal infiltration - transparent or opaque?
Subtle corneal opacities
Endothelial deposits
Linear keratopathy lesions and Haab’s striae

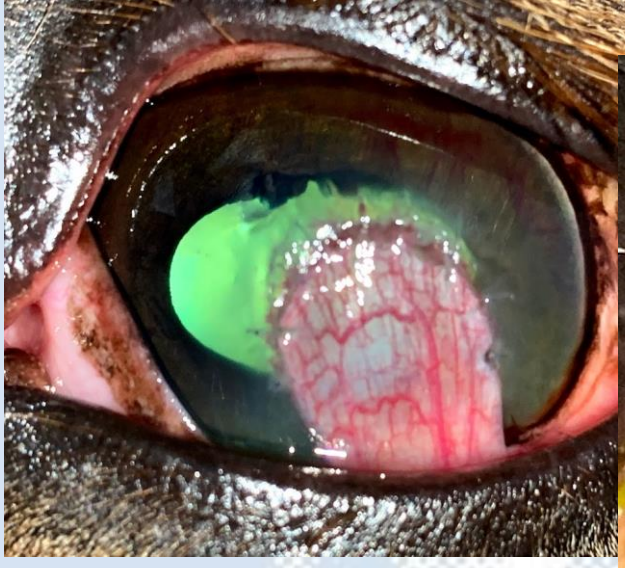


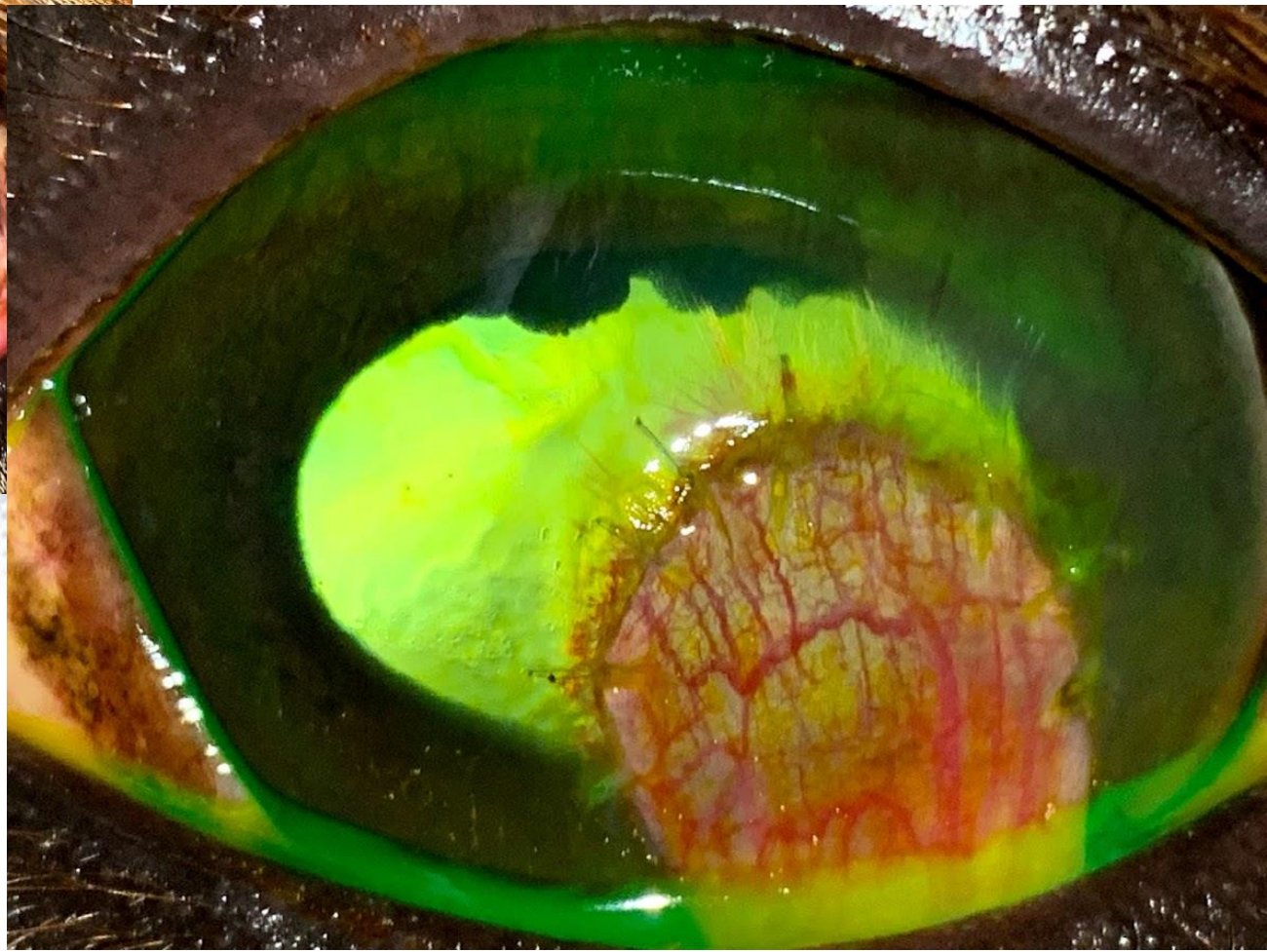


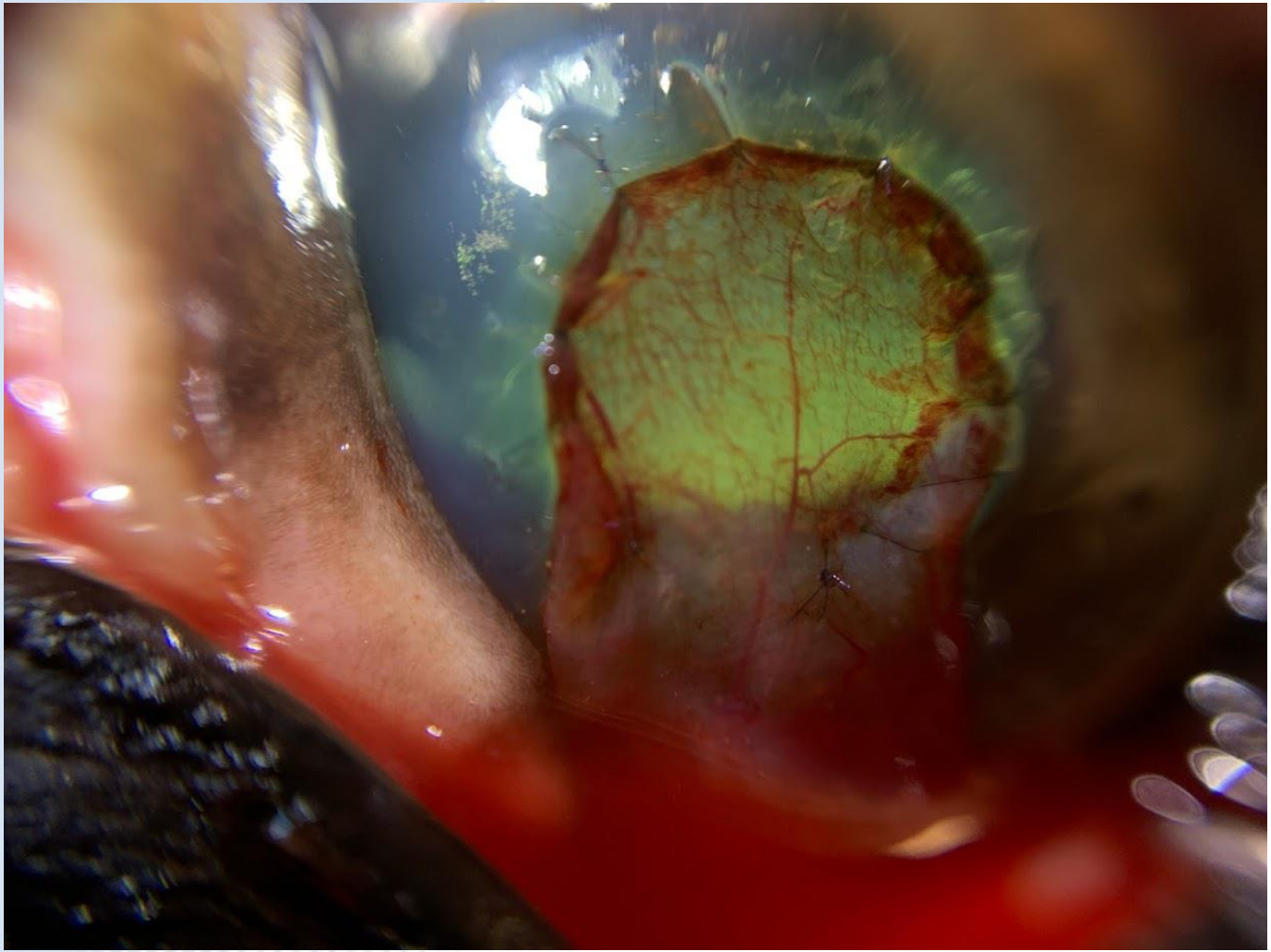
Transparency? Distant direct

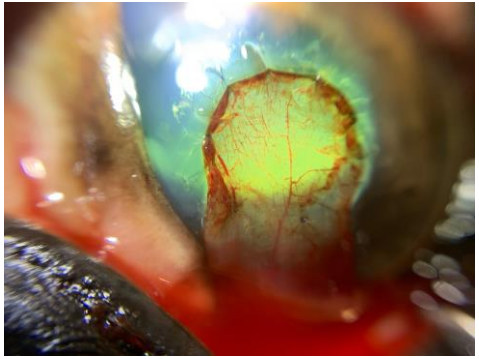
Retroillumination

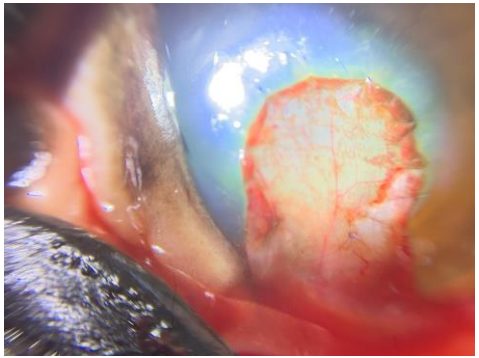












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Corneal reflection obscures detail

iPhone XS Max, x10 macro & modelling light

Slit lamp photography

Digiscoping vs macrophotography

Adaptor attaches phone to slit lamp eye piece

Use voice activated software to take image (“Hey Camera”)

Care when attaching

Can be fiddly with large phones (iPod)

Image what the slit lamp sees

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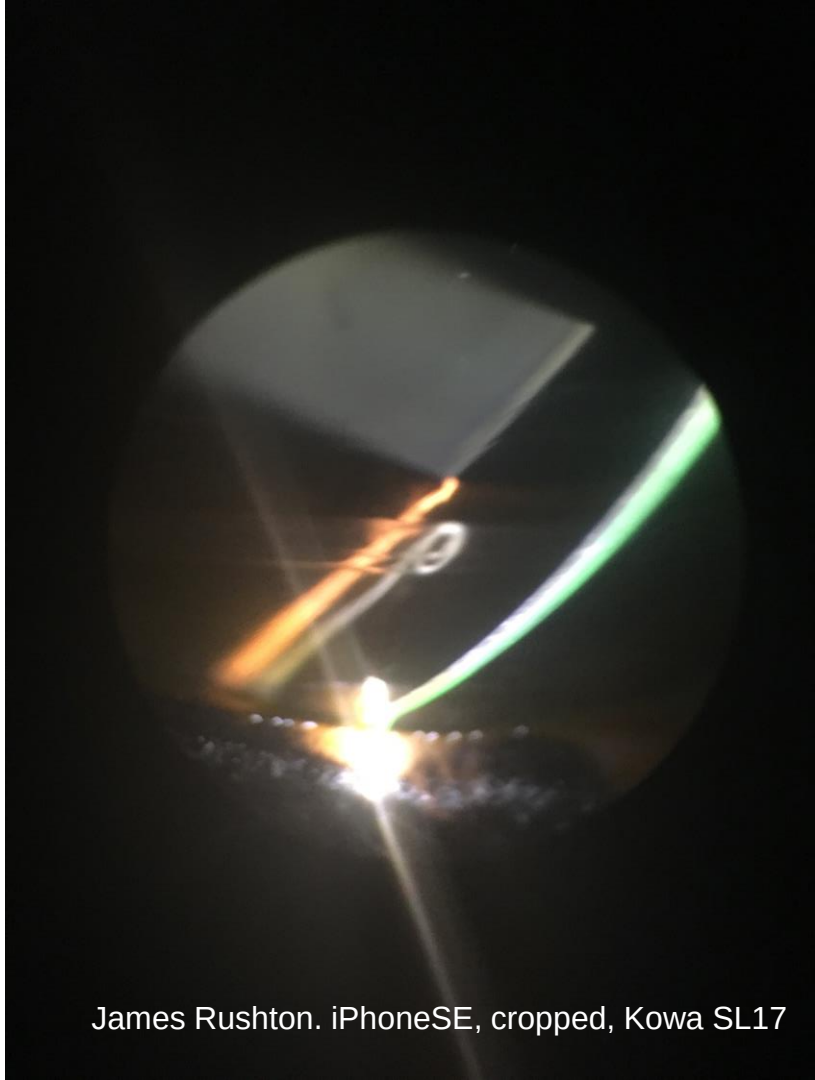

James Rushton. iPhoneSE, cropped, Kowa SL17

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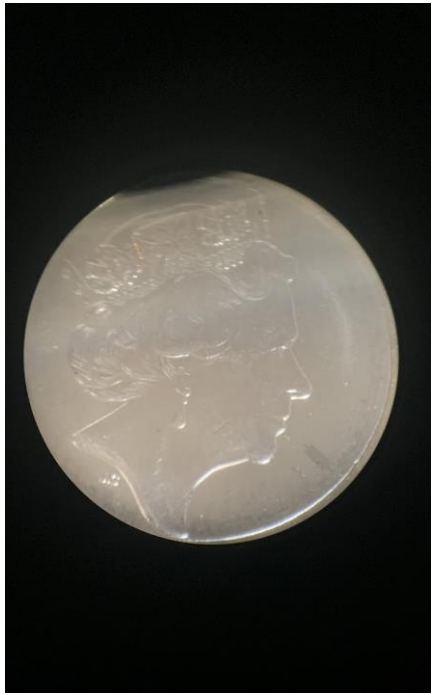
Remember your telephoto lens



Digiscoping vs macrophotography

“Image the slit beam with macrophotography or digital zoom”

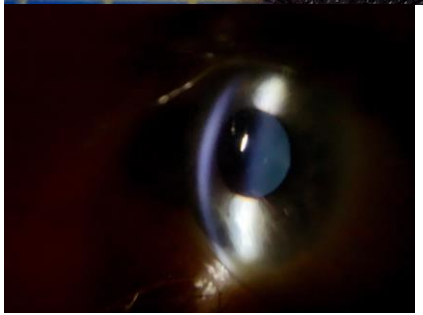
Need two people – usually

Binocular or monocular slit lamp

Slit beam on ophthalmoscope or pen torch

Lens-less slit beam adaptor

iPhone XS, x10 macro lens, slit beam adaptor



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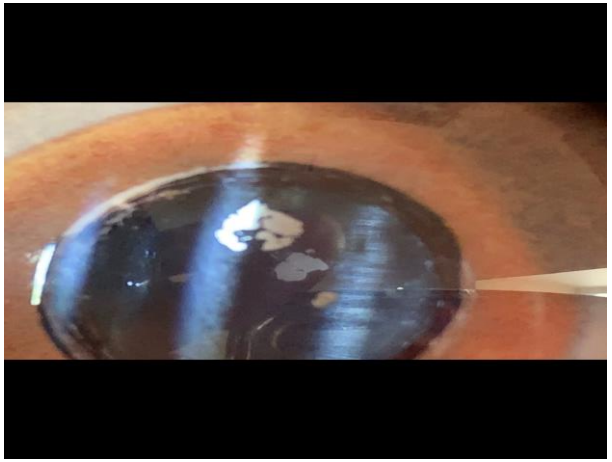

iPhone XS, digital zoom, slit beam adaptor

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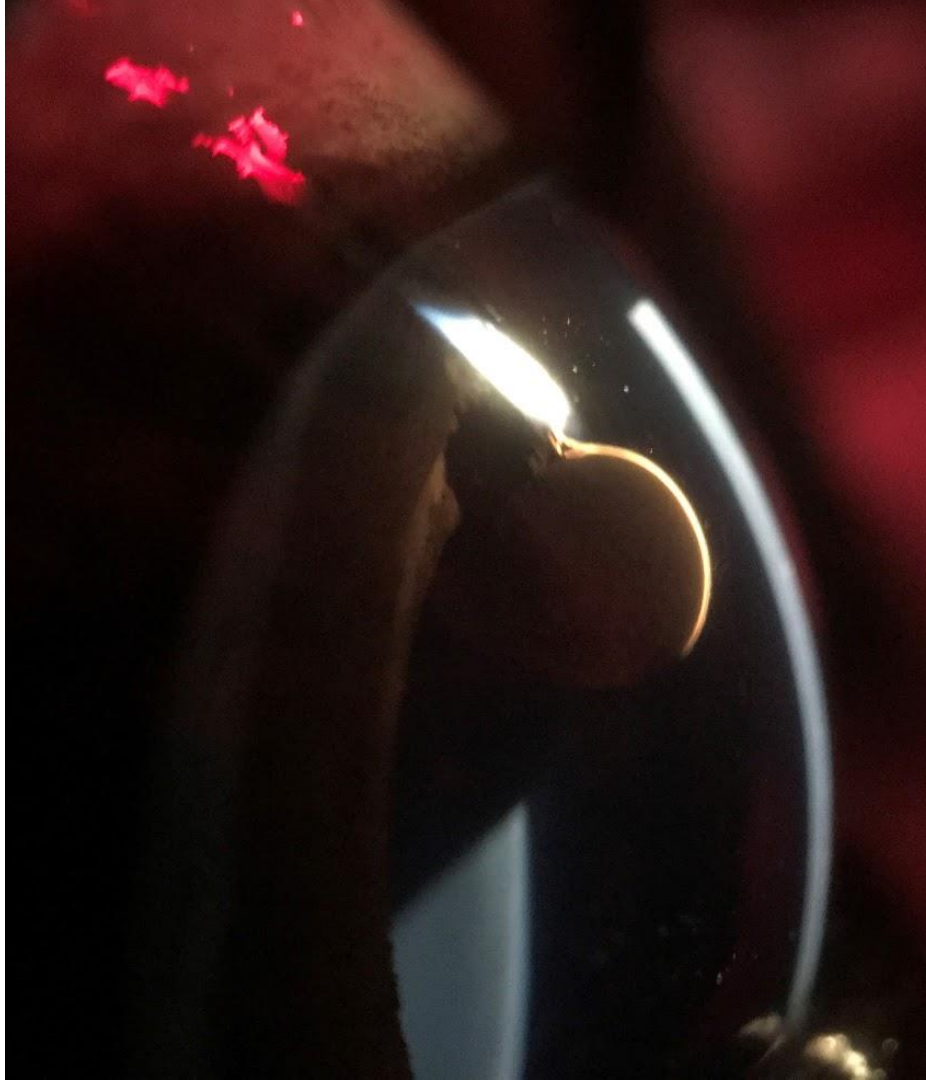

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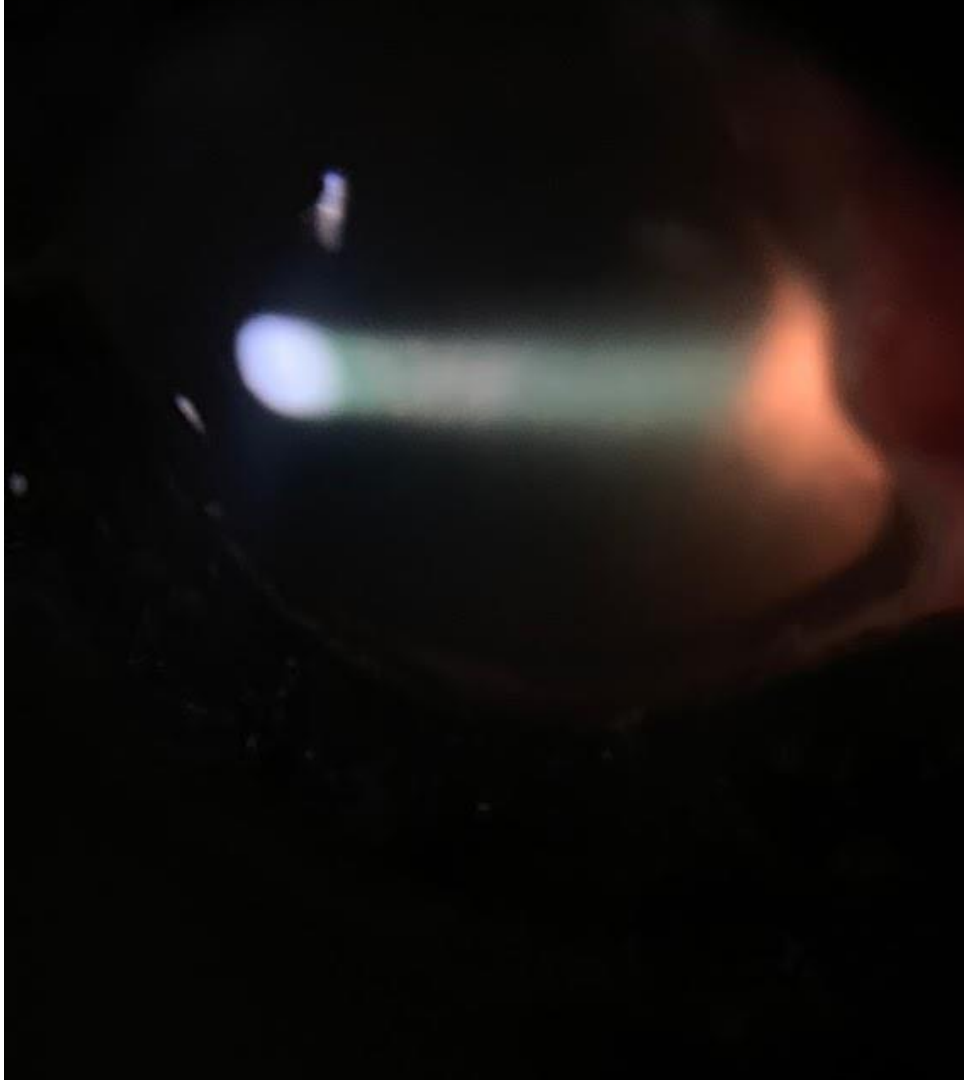

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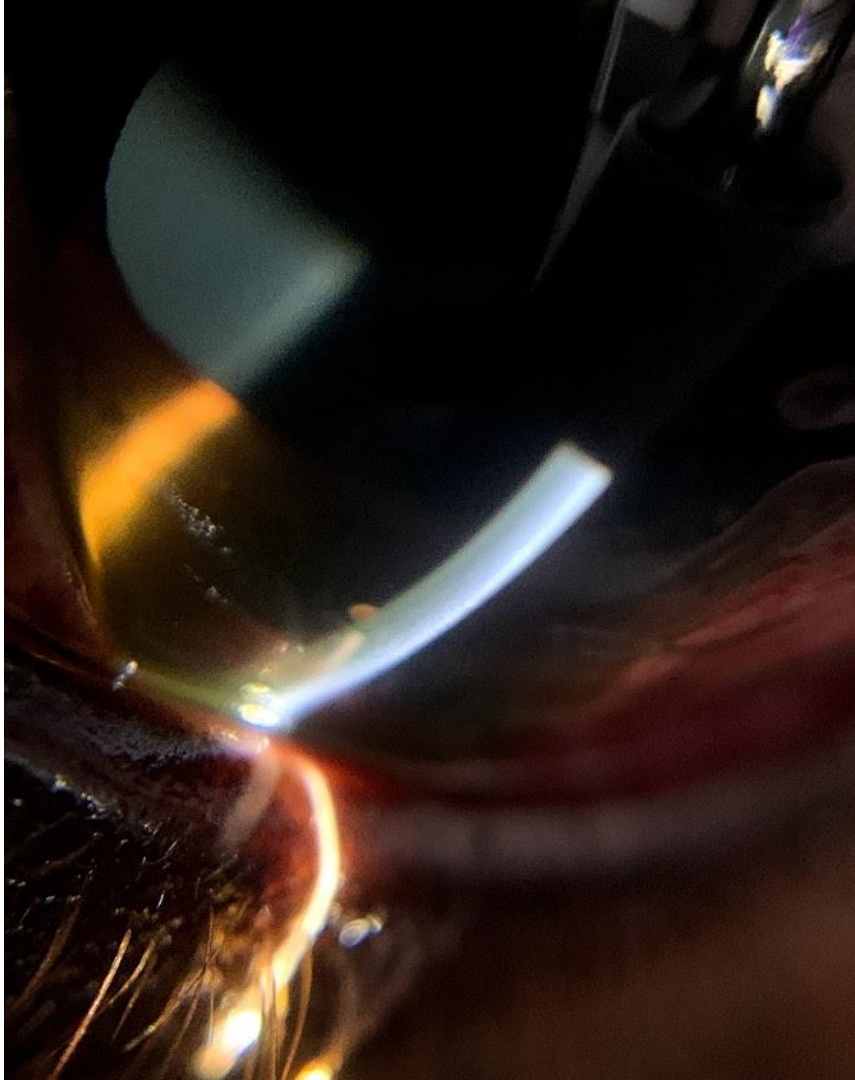

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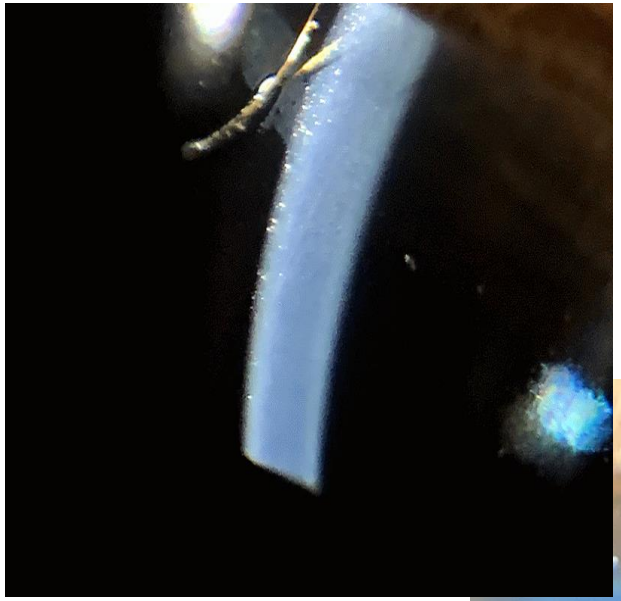
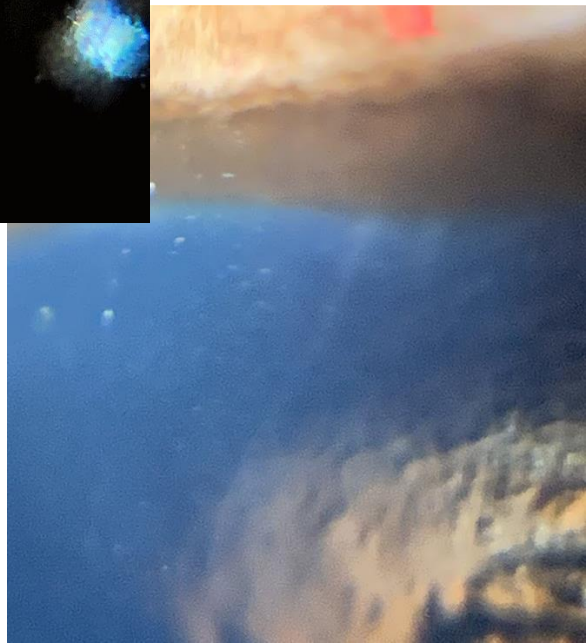
Video helpful for complex lesions





iPhone XS, x10 macro lens, cropped, Kowa SL17

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Post processing can help find hidden detail

iPhone XS, x10 macro lens Kowa SL17

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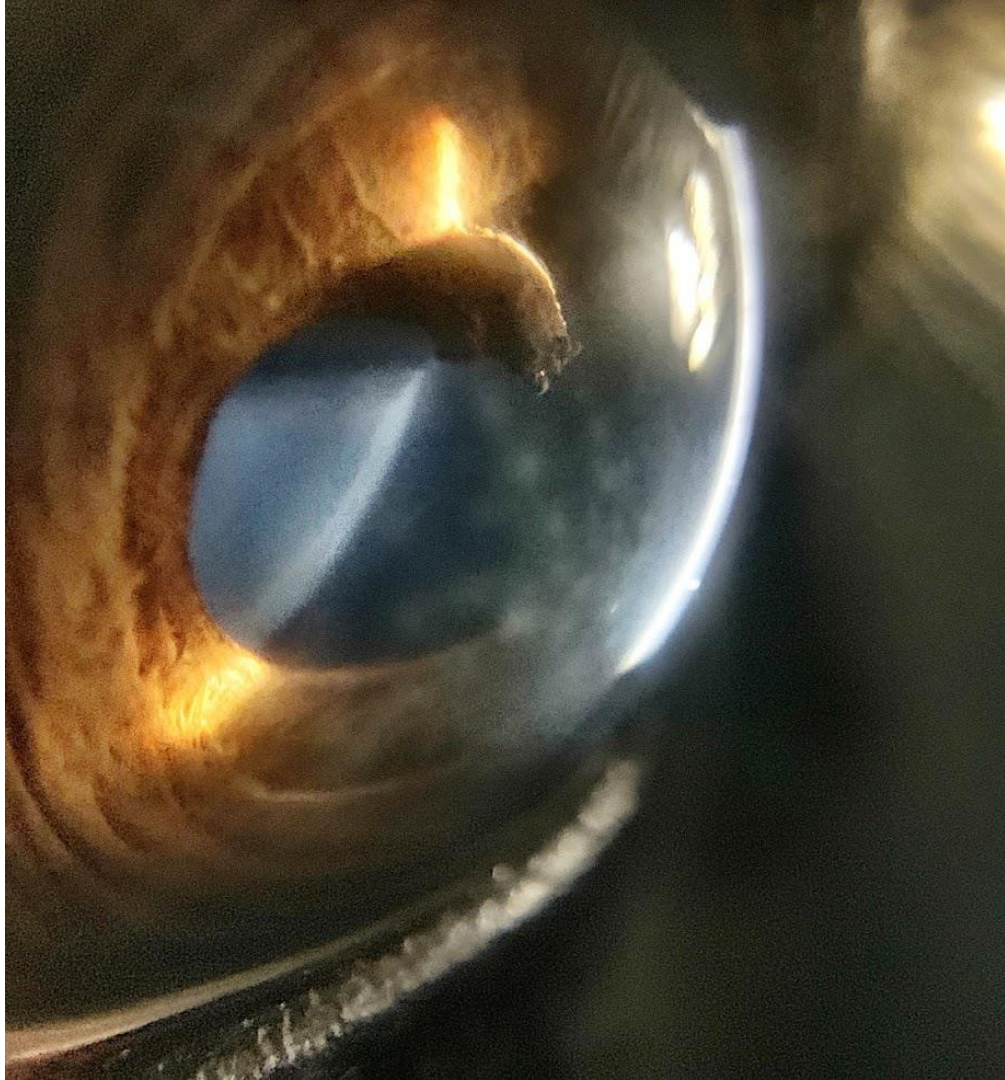

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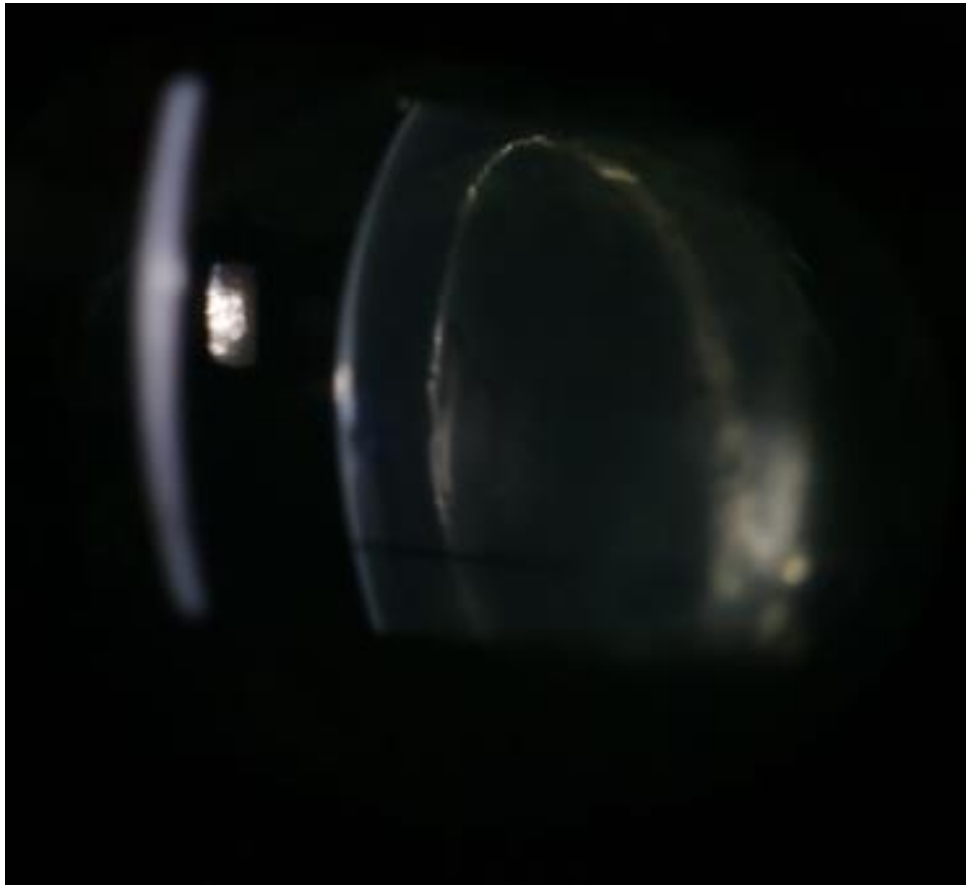
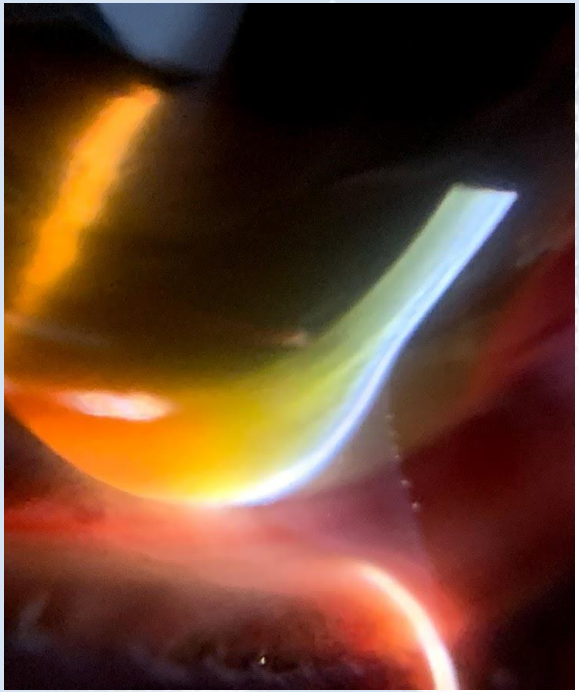
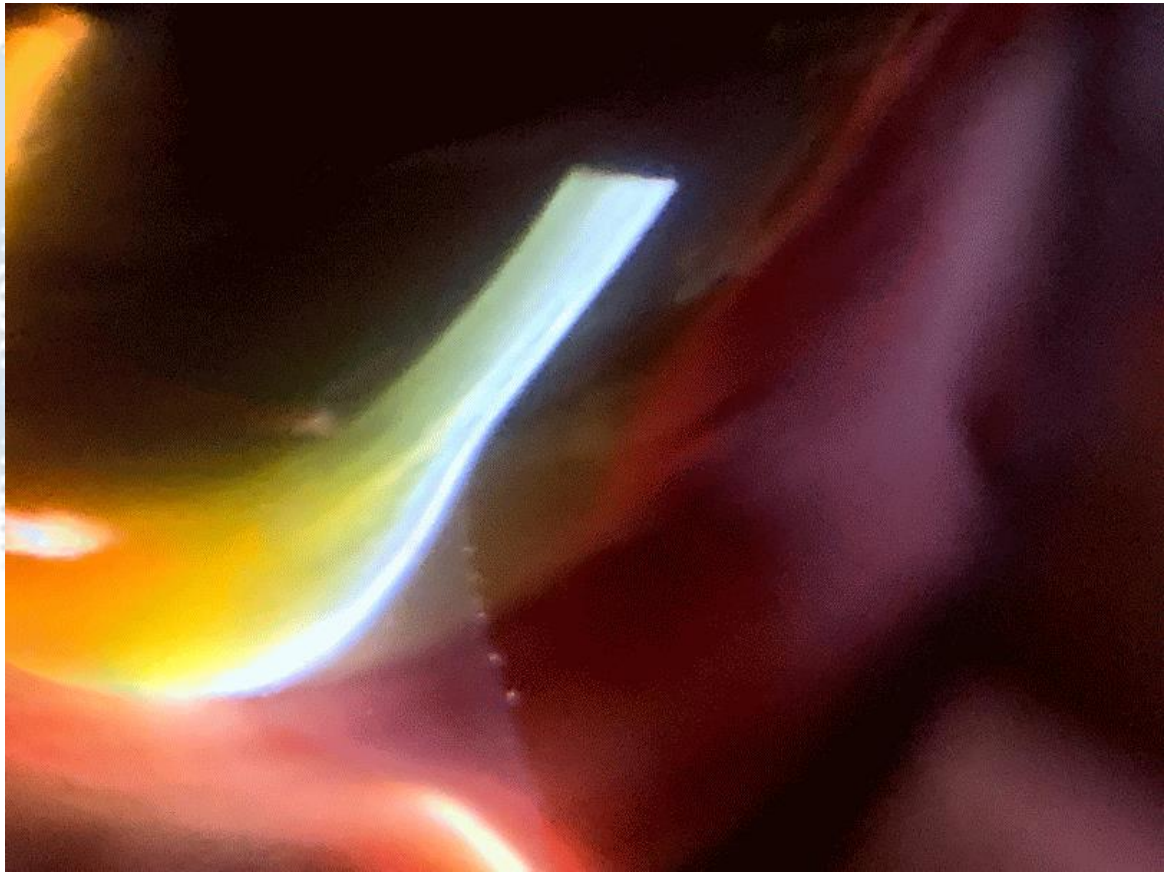
DSLR’s are better then smartphones

Canon 760D, 50 mm f1.8, extension tubes f8 ,ISO 1600, 1/30s, Kowa SL17



GIFs
Apple iPhone XS Max
ƒ/1.8 1/33 4.25mmISO400



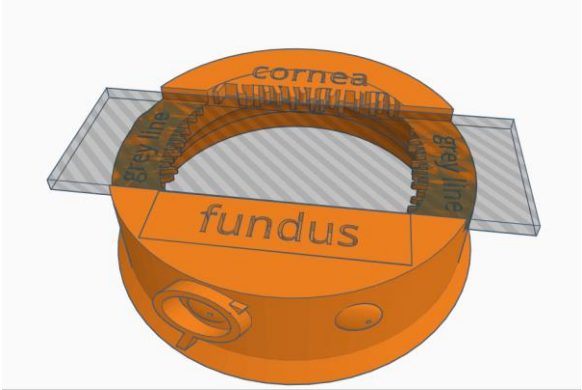


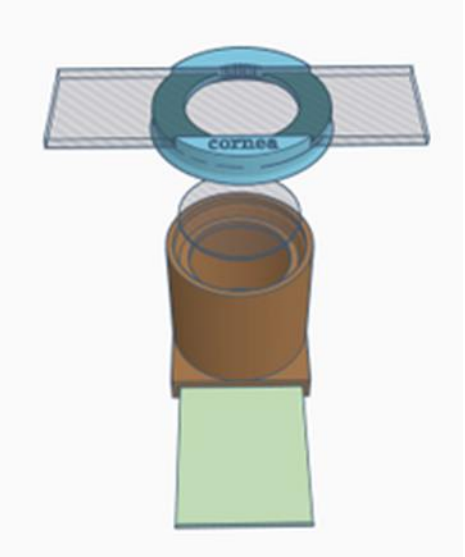
Practical session 2: the cornea

Key skills

- Use DD to identify opacities and focal refractive corneal lesions
- Use Macro lens to obtain magnified view of lesions
- Use direct (oblique broad beam) and indirect (retroillumination and “sclerotic” scatter) lighting techniques to document corneal opacities

Set up model in “cornea mode”, use corneal slide and ensure there is a retina and a lens in the model to give you a tapetal reflection.





Task 1: Use Distant direct to identify & image opacities and refractive errors

Arm's length technique allows both fundic reflexes to be assessed.

Distance = ↓ light intensity = ↓ miosis

Distance = ↓ light intensity = Opacities appear as shadows

Distance = ↓ light intensity = refractive changes visible against a muted fundic reflex

Tip: Use digital zoom to fill the screen

Task 2: Use macro lens to image corneal opacities

Remember to remove the outer (0.67) lens, remove phone case & turn torch mode off.

Position over lens.

Practice supporting hand to allow micro movements for fine focus.

Try with and without additional light

Corneal reflections can sometimes be documented which helps to assess the PCTF

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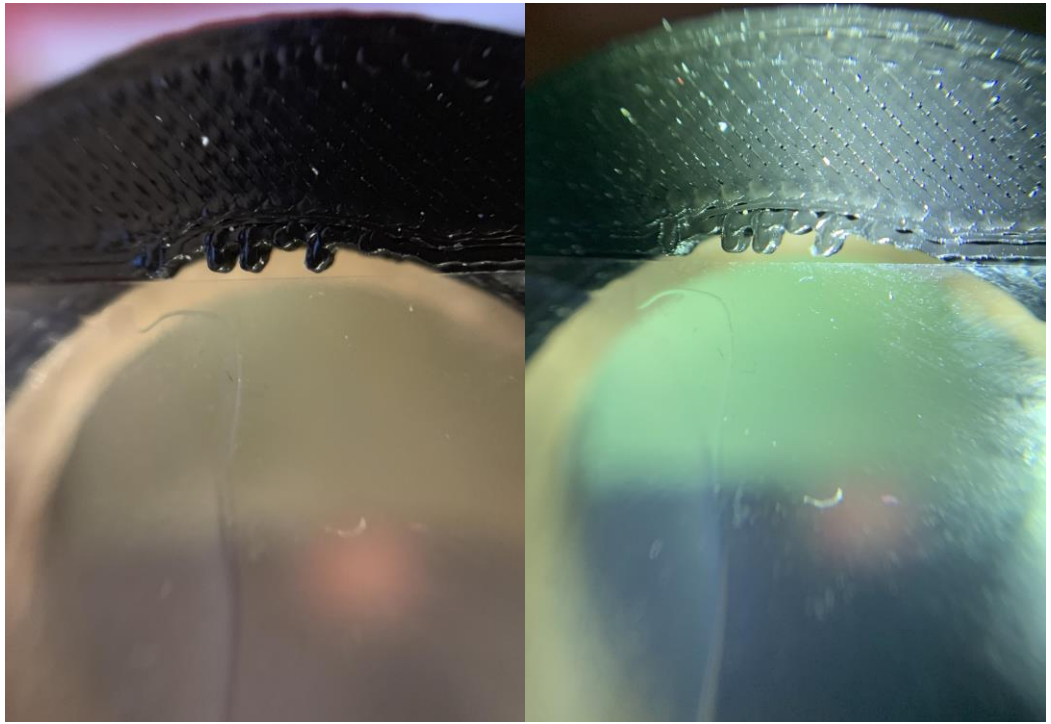

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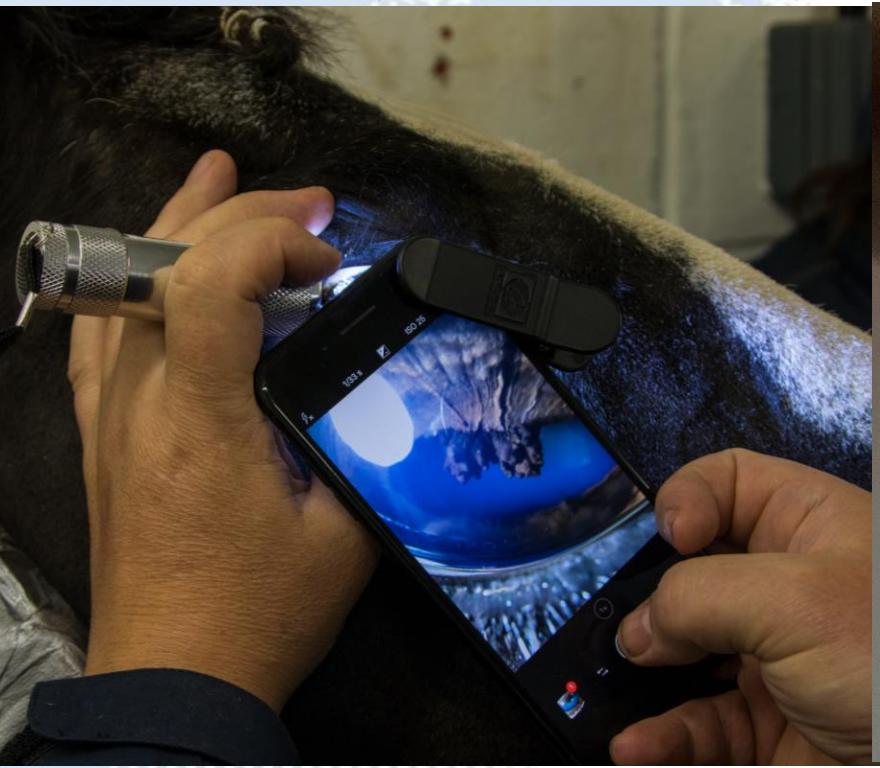
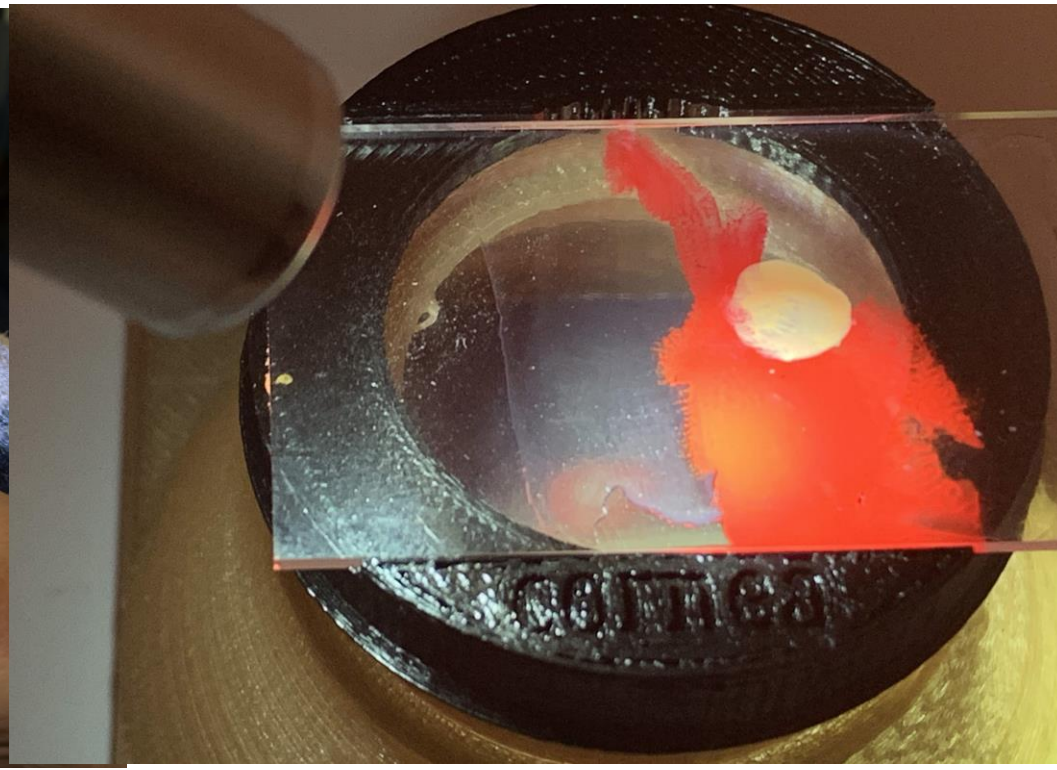
Try with and without additional light

Corneal reflections can sometimes be documented which helps to assess the PCTF

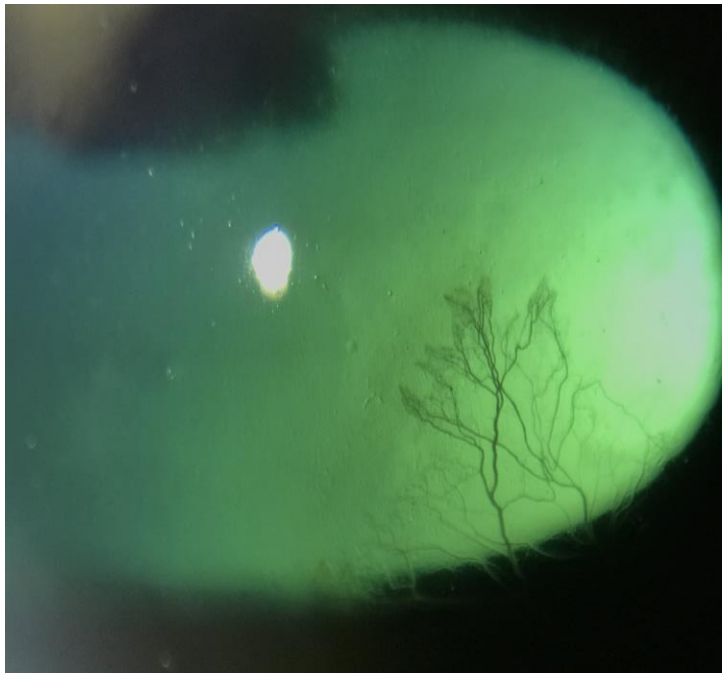
Task 3: Use oblique lighting to image the corneal lesions: practice on your model.





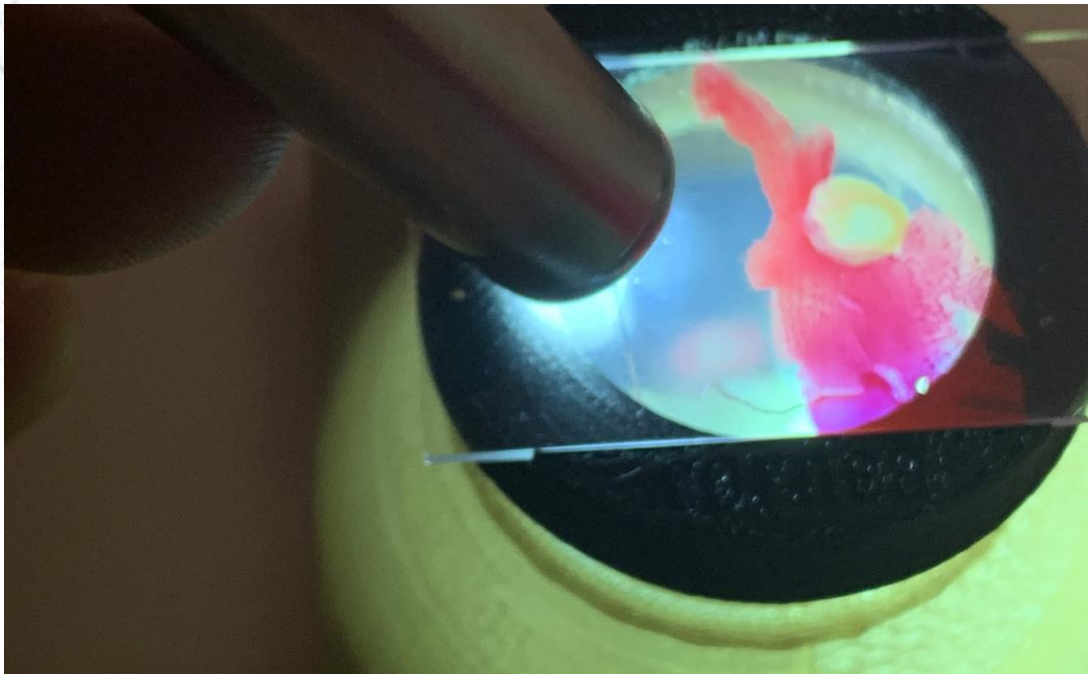
Task 4: Use retroillumination to image corneal lesions

iPhone XS Max- operating microscope eye piece image



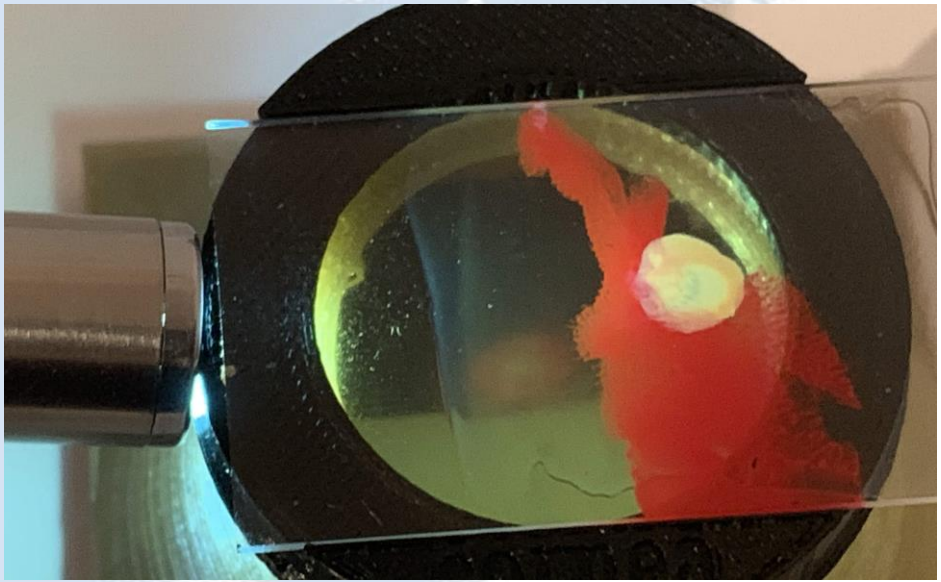
iPhone 7plus and 12x macro lens

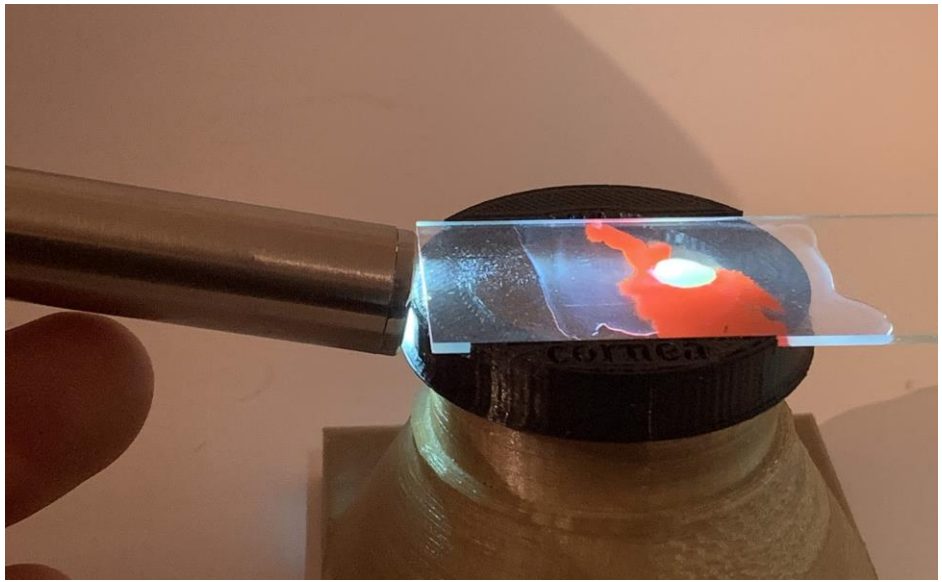
Task 4: Use retroillumination to image corneal lesions



iPhone XS Max- operating microscope eye piece image

Task 5: Simulate “sclerotic scatter like” technique to illuminate and image corneal lesions.





Task 5: Simulate “sclerotic scatter like” technique to illuminate and image corneal lesions.

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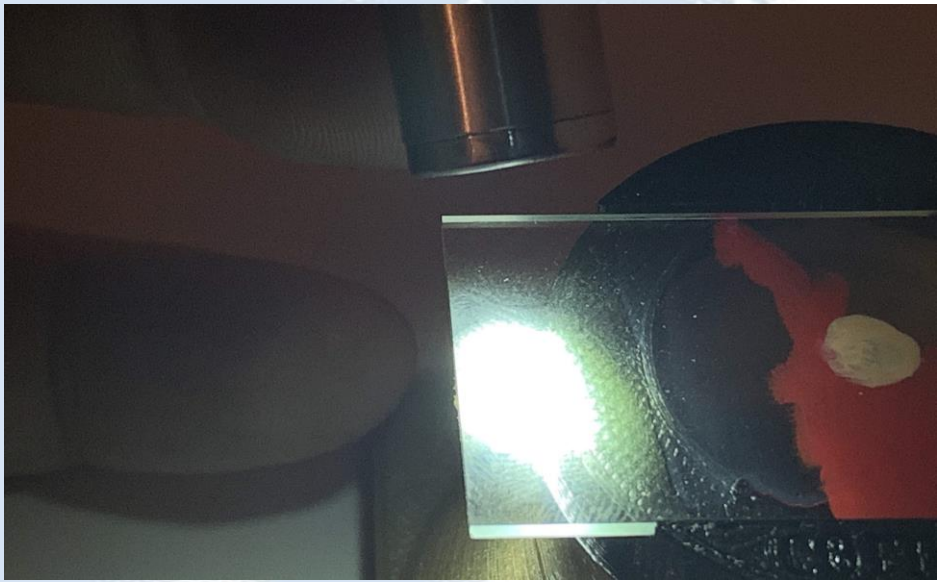

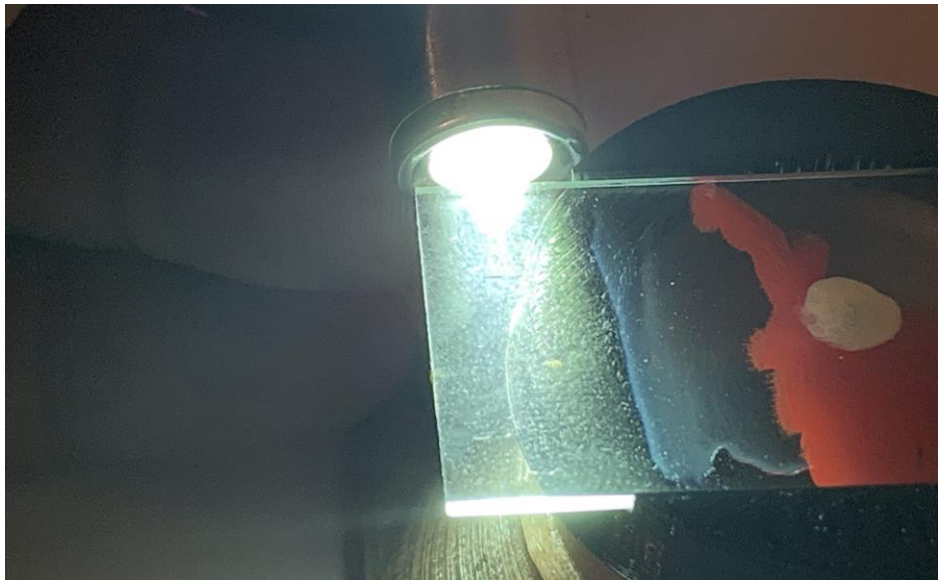
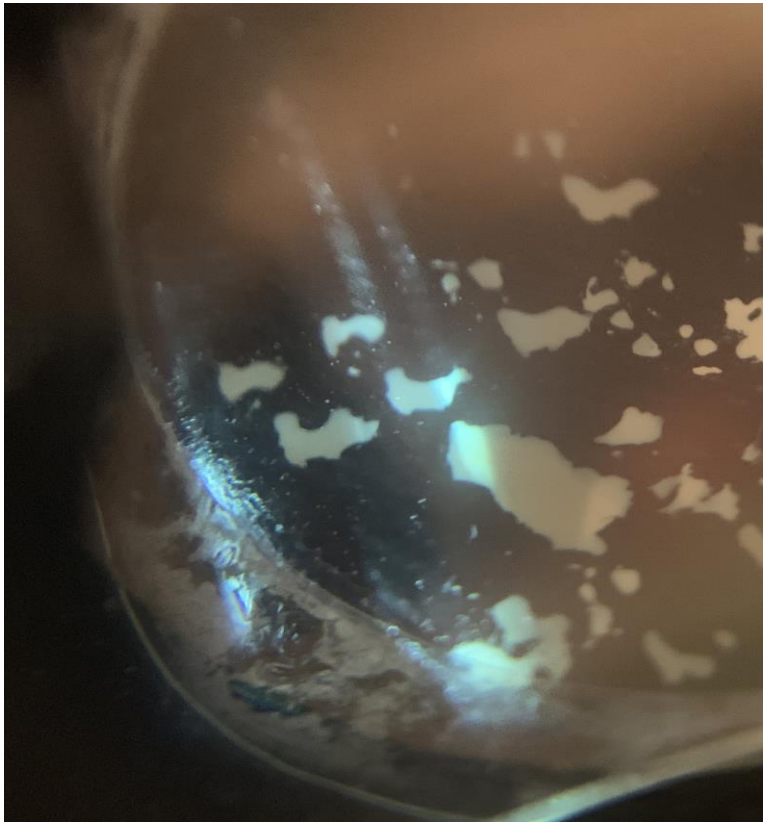
Try the slit beam with the macro lens