Imaging the anterior segment
Basic skills

- Learn to embrace the narrative – tell a story *
- Distant direct “phoneoscopy”
- Smartphone Macro Photography
- Learn to use lighting
- Slit lamp photography

*Google photos assistant automatically makes “case videos” for you
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
Distant direct phoneoscopy

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Distant direct phoneoscopy

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- 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?)
Macro lens

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- iPod touch vs iPhone 7+
modelling lights vs on-phone light
focus with micromovements
Creative holding techniques
Use digital zoom
Improving your macro-photography
EXIF data

- Date Taken: Mar 27, 2017, Mon, 1:53 PM
- Camera: Apple iPhone 7 Plus
  - Resolution: 12.2 MP, 3024 x 4032
  - Focal Length: f/1.8, 1/33s, 3.99mm, ISO 64
- Location: Unknown location
Macrophotography

Apple iPhone XS Max

f/2.41/2566mm ISO16

X10 macro lens, modelling light

Flesh fly (Sarcophaginae spp.)
Macrophotography

Apple iPhone XS Max

f/2.41/1226mmISO25

X10 macro lens

Cucumber green spider (Araniella cucurbitina)
Macrophotography

Apple iPhone XS Max,
f/2.41 1226mm ISO25,
X10 macro lens

Shield bug
(Acanthosomatidae spp.)
Macrophotography

Shield bug (Acanthosomatidae spp.)

Apple iPhone XS Max, ƒ/2.4 1/1226mm ISO 25, X10 macro lens
critique

12.2MP 4032 × 3024 6.7 MB  
f/1.81/504.25mm ISO100

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

iPhone XS Max, x10 macro & modelling light
critique

12.2MP 4032 × 3024 6.7 MB
f/1.81/504.25mm ISO100

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

iPhone XS Max, x10 macro & modelling light
Focus - DOF

12.2MP 4032 × 3024 7 MB
f/1.81/504.25mm 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/2.41/306mm 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
f/1.81/504.25mm ISO80

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
Digiscoping vs macrophotography

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Image what the slit lamp sees

*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, Kowa SL17
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Video helpful for complex lesions

iPhone XS, x10 macro lens, cropped, Kowa SL17
Digiscoping vs macrophotography

“Image the slit beam with macrophotography or digital zoom”

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Post processing can help find hidden detail

iPhone XS, x10 macro lens Kowa SL17
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iPhone XS, x10 macro lens Kowa SL17
Digiscoping vs macrophotography

“Image the slit beam with macrophotography”

Need two people – usually

Binocular or monocular slit lamp

Slit beam on ophthalmoscope or pen torch

DSLR’s are better than smartphones

*Canon 760D, 50 mm f1.8, extension tubes f8, ISO 1600, 1/30s, Kowa SL17*
GIFs
Apple iPhone XS Max
f/1.81/334.25mm/ISO400
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:

<table>
<thead>
<tr>
<th>Questions</th>
<th>Lesions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reflectance</td>
<td>Deep ulcers - it’s all about the angles</td>
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<tr>
<td>Transparency</td>
<td>Stromal infiltration - transparent or opaque?</td>
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<tr>
<td>Visual axis Significance</td>
<td>Subtle corneal opacities</td>
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<tr>
<td>Depth</td>
<td>Endothelial deposits</td>
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<tr>
<td>Curvature</td>
<td>Linear keratopathy lesions and Haab’s striae</td>
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<tr>
<td>Profile</td>
<td></td>
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</tbody>
</table>
Transparency? Distant direct
Retroillumination
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
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
Task 2: Use macro lens to image corneal opacities

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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
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

James Rushton. iPhoneSE, Kowa SL17
Imaging the drainage angle
Imaging the iris
Close vs macro
Saffire’s story

- iPhone 7plus
- Digital zoom
Saffire’s story

- iPhone 7 plus, digital zoom, Kowa SL17
Saffire’s story

- Oblique lighting
- Macro x10 iPhone 7 Plus
Saffire’s story

- iPhone 7plus
- Operating microscope view
Saffire’s story

- iPhoneSE
- Digital zoom
Saffire’s story

- iPhone 7plus
- Distant direct view, torch mode, digital zoom
Team saffire
Jemima: She's been a very good girl thank you Tim an...

MESSAGES

James Rushton New Iphone
12/11/2018
saffire looking amazing, quite an accomplishment, congrats, w...

Hooman
12/11/2018
Saffire's most recent picture - off all meds an back to work

Eye vets 2018
12/11/2018
This is Saffire the double iridectomy from a few weeks ...

Team saffire
11/18/2018
Saffire doing so well will help other horses as it will give us...

Team saffire
11/18/2018
Nelson thinks the fibrin all gone after the clot busting injec...

Team saffire
11/17/2018
Saffire doing amazingly well!! Small blood clot and some...

Team saffire
11/18/2018
Generally pleased with saffire when checked late last ni...

Team saffire
11/14/2018
Really pleased with saffire - there's a little bit fibrin in t...

Team saffire
11/13/2018
All done - op went well and most imp of all saffire f...

Team saffire
11/13/2018
Hi Tim these are the photos Jaqui took on Friday. Hope they are ok?
Imaging the lens
Practical session 3: iris & lens
Practical session 3: iris & lens

Key skills
● Use DD to identify lens opacities
● Use DD to localise lesions using parallax
● Use Macro lens to obtain magnified view of iris face and anterior lens lesions using both direct (oblique broad beam) and indirect (retro illumination) lighting techniques to document lens opacities
● Use slit beam adaptor on pen torch, localise lens opacities using slit beam and image with and without the macro lens

Equipment needed
● Smart phone.
● Camera app which allows light to be in “torch mode” whilst capturing images.
● Pen torch +/- slit lamp adaptor.
● Macro lens
● Eye model set up in “anterior segment” mode. (1) simple lid (2) retinal image (3) top planoconvex lens with no opacities (4) paper iris (5) bottom planoconvex lens with painted anterior and posterior “lens” opacities.
Task 1: Use Distant direct to identify & image lens opacities using eye model

Distant direct at 30cm

“Close” Distant direct at 10cm
Task 2: Use macro lens to image iris and anterior lens opacity using eye model
Task 3: Use retroillumination to image the lens lesions
Task 4: Simulate slit beam illumination technique to localise and image lens lesions
Task 5: Use your new macro lens skills to image your partner’s anterior chamber.

Oblique illumination, 10x macro lens, iPhone 7plus. Post processed with HDR type filter (Camera +, “Clarity filter”)

WhatsApp me your best image for a prize!
+447782219868