Corneal topography and dystrophies: corneal lumps, bumps and getting old

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Acknowledgements

- ESA Orthoptists and administration staff
- Pentacam
- Today is about learning and discussion rather than getting answer correct.

No financial disclosures
Corneal topography

1. Keratoconus monitoring
2. Pre cataract surgery
   – Toric IOL planning
   – Management of expectations
3. Refractive surgery assessment
4. Post graft astigmatism
5. Monitoring for progression of corneal disease
6. Contact lens fitting (#)
Normal corneal topography
Corneal topography

- Prolate (42-43D) v oblate
- Prolate
  - Normal cornea
  - Keratoconus
  - Post hyperopic laser
- Oblate cornea:
  - Post myopic laser vision correction (LASIK or PRK)
  - Post radial keratotomy
Regular corneal astigmatism

- Bow tie appearance
  - Red is steep (AFL ball)
- Orthogonal meridians
- No inferior/superior curvature asymmetry
- Moves WTR to ATR
Axial v tangential curvature
Keratoconus
Keratoconus v Pellucid MD
Indications for cross linking

- Topographic progression >0.5 – 1.0D/yr
- CL base curve reduction
- Thinnest pachymetry: >350 – 400um: endothelium
- Absence of significant scarring
- Loss BCVA
- Other factors:
  - Strong family history: KCN/keratoplasty
  - Eye rubber
  - Severity
  - Absolute VA

General comments

Parameters to assess progression in keratoconus
ACGR: Keratoconus: transplants/yr
ACGR: Keratoconus transplants: age/yr
Q1: Left eye acute blurred vision

Left UCVA 6/190
Refraction -14.00/-7.00 x 90: 6/95

POH Keratoconus

What is your diagnosis?
Slit lamp and topography

RE VA with CL: 6/9.6

LE Refraction: -18.00/-8.00 x 90: 6/38
Q2: Right eye

2015
6/9.6
5.50/-2.75 x 85: 6/6
Central K’s 41.0/44.6
(42.8)
Kmax: 53.4

2017
6/15
7.00/-3.00 x 70: 6/12
Central K’s: 42.2/45.7
(44.0)
Kmax: 56.0

2018
6/12
1.25/-2.00 x 45: 6/12
Central K’: 40.6/45.6
(43.1)
Kmax: 60

Would you treat?  
CXL 2018  
Kmax: 58.3 (Aug 2019)
Q3: Right Eye Post LASIK

Deteriorating vision
Difficult refraction

2014
-2.00/-2.25 x 60: 6/9.5
Central K’s: 41.48/43.67
(42.58)

2016
-2.75/-1.75 x 80: 6/19
Central K’s: 42.85/46.29
(44.57)
Q3: Right Eye Post LASIK

2017
6/24
-1.50/-3.00 x 82: 6/15
Central K’s 44.0/47.0 (45.5)
Kmax: 50.4

2019
6/24
plano/-5.00 x 95: 6/9.6
Central K’s: 44.8/48.0 (46.4)
Kmax: 52.8

2019
6/30
plano/-4.00 x 110: 6/15
Central K’: 44.9/47.9 (46.4)
Kmax: 52.4

Would you perform cross linking?

Right CXL 2017
Q4: Same patient: left eye

2017
6/19
-0.25/-1.25 x 112: 6/9.6
Central K’s 40.5/41.7 (41.1)
Kmax: 44.8

2019
6/38
-1.00/-2.50 x 110: 6/7.5
Central K’s: 40.9/42.5 (41.7)
Kmax: 45.6

2019
6/38
2.25/-2.50 x 105: 6/9.6
Central K’: 40.5/42.4 (41.45)
Kmax: 45.8

Would you perform CXL?
Q5: Would you CXL?

18 Female
Right: 6/48
-1.25/-4.00 x 505: 6/12
Left UCVA 6/120
-1.00/-4.00 x 100: 6/75

“Vision getting worse”

Any further questions:
• Family history
• >50% KCN
• 1 keratoplasty

Thinnest pachymetry:
Right: 408µm
Left: 339µm
Post graft astigmatism

Keratoconus

Left PK

Sutures out at 18/12

Post ROS: -2.00/-12.00 x 8: 6/30

Post relaxing inc: -1.50/-2.75 x 155: 6/12
Progressive keratoconus

18 male

HCL wearer:
Right: 6/9
Left: 6/6
Post cross linking flattening

12/12 post
Mean K: 56.85
K max: 69.4

Pre CXL:
Mean K: 61.55
K max: 75.55
Pentacam comparison map

<table>
<thead>
<tr>
<th>Exam A</th>
<th>Exam B</th>
<th>Difference A - B</th>
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<tbody>
<tr>
<td>0.7 D</td>
<td>0.4 D</td>
<td>+0.3 D</td>
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<tr>
<td>46.7 D</td>
<td>47.9 D</td>
<td>+0.2 D</td>
</tr>
<tr>
<td>18.8°</td>
<td>21.2°</td>
<td>+2.4°</td>
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<td>0.03</td>
<td>0.04</td>
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<tr>
<td>515 μm</td>
<td>507 μm</td>
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<td>400 μm</td>
<td>407 μm</td>
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<td>8.79</td>
<td>8.59</td>
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<td>0.37 mm</td>
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<td>+0.02</td>
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<tr>
<td>0.27 mm</td>
<td>0.32 mm</td>
<td>+0.05</td>
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<td>A C Depth (int): 3.27 mm</td>
<td>A C Depth (int): 3.32 mm</td>
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<td>A C Depth (int): 3.27 mm</td>
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Children: Kmax change by patient

* Median time from surgery to last follow-up was 21 months (IQR 14, 51)
Age at surgery (y) of each subject is shown within the bar
1. Pterygium

56yo keen bike rider PSCCs

Right: -2.00/-2.00 x 180: 6/9

Left: -3.00/-2.00 x 175: 6/9

Glasses dependent
Pterygium: Right > left
Q6: Which of the following diagnoses is unlikely?

- Keratoconus
- Post myopic LASIK
- Post radial keratectomy
Previous refractive surgery

Q6: Is this corneal prolate or oblate?
Q7: What is your diagnosis right eye?
• Normal post myopic LASIK topography
• Normal post hypermetropic LASIK topography
• Post LASIK ectasia
Q8: What is your diagnosis?
• Keratoconus
• Post LASIK ectasia
• Normal post myopia LVC
Blurred distance VA RE post 9/12 cataract surgery

RE UCVA 6/12
-1.00 / -0.50 x 95: 6/7.5
Toric IOL @ 80

LE UCVA 6/9.6
+0.50 / -0.25 x 170: 6/7.5
Left significant cortical cataract

Other investigations and why?  Treat right or left next?  Explanation?
Why is topography important pre cataract surgery?

R: -1.00/-1.50 x 170: 6/7.5

L: 0/-0.50 x 50: 6/4.8
Why is topography important pre cataract surgery?

Prognosis
Cataract surgery planning

Anterior curvature 24

Total corneal power (Barrett) 17

[Image of corneal curvature map]

[Image of eye diagram]

SE: 44.95 D (SD = 2 µm)
K1: 44.42 D @ 114° (SD = 6 µm)
K2: 45.49 D @ 24° (SD = 2 µm)
Δ D: +1.07 D @ 24°
Pentacam: measurement of total corneal power

Anterior map

Total corneal power map

0.4D @ 41

Axis @ 31
Perfect toric case

R: 1.50/-1.50 x 98: 6/7.5

L: 0/-3.00 x 93: 6/9.6

-1.00/-0.25: 6/6

-0.50/-1.00 x 63: 6/6
20yo Female Refractive surgery candidate

R: -4.00/-1.00x140:6/6  L: -5.50/-0.50x20:6/6
20yo Female Refractive surgery candidate

R: -4.00/-1.00x140:6/6  L: -5.50/-0.50x20: 6/6
20yo Female Refractive surgery candidate

R: -4.00/-1.00x140:6/6  
L: -5.50/-0.50x20:6/6
20yo Female Refractive surgery candidate

R: -4.00/-1.00x140: 6/6  
L: -5.50/-0.50x20: 6/6
Fuchs endothelial corneal dystrophy (FEC)

- Onset: 40’s (30’s if familial), progressive
- Females > right
- Symptoms:
  - Blurred VA morning
  - Late: pain
- Signs:
  - Central
  - Cornea guttata +/- pigment dusting
  - Stromal oedema/DMF
  - MCO/bullae
Fuchs endothelial dystrophy (FECD)

- Specular microscopy
  - Reduced EC density
  - Polymegathism
  - Pleomorphism
Fuchs endothelial corneal dystrophy (FECD)

• Management:
  – Exclude inflammatory cause (?HSV)
  – Hypertonic saline (MURO 128)
  – Hair dryer in morning
  – Endothelial keratoplasty (“EK”)

Ben Connell
Cataract surgery in FED

Timing of surgery

• Early surgery
  – Less endothelial cell loss
  – Less risk stromal oedema
  – Faster recovery

• Late surgery
  – Less endothelial cell reserve
  – More persistent corneal oedema
Epithelial basement membrane dystrophy

- Map-dot-fingerprint dystrophy
- Cogan microcystic epithelial dystrophy
- Anterior basement membrane dystrophy

- Common: 5-10% of population
Epithelial basement membrane dystrophy

• Adult life
• Signs
  – Cysts
Epithelial basement membrane dystrophy

• Signs
  – Maps
Epithelial basement membrane dystrophy

• Signs
  – Finger print lines
Epithelial basement membrane dystrophy

• Signs
  – Corneal epithelial defect
  – *examine contralateral eye carefully in corneal ulcer presentation

• Symptoms
  – Asymptomatic
  – Pain/lacrimation
Epithelial basement membrane dystrophy

• **Treatment**

  – **CED:**
    • Antibiotic (if CED)
      – G v OC
      – 6-12 months
    • Debride

  – No CED: lubricants

  – Bandage soft contact lens
Epithelial basement membrane dystrophy

• Treatment
  – Counselling
    • Infection risk
    • Expectations
    • Minimise exposure to dryness
      – Air conditioning/heating
      – Car
    • Long term
    • Will get recurrences
Epithelial basement membrane dystrophy

- **Longer term treatment**
  - Anterior stromal puncture
    - Multiple, small anterior punctures
    - Non visual axis
Epithelial basement membrane dystrophy

- **Treatment**
  - Phototherapeutic keratectomy
  - 80% success
  - Lubricants important post-operatively
  - Expectations
    - Less frequent, less severe
Epithelial basement membrane dystrophy

• PTK risks
  – Infection/loss BCVA
  – Refraction change
Questions?