Cataract surgery in corneal disease

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Why

- Cataract vs Cornea
- Biometry Assumptions
- Lack of lens choice
- Technical challenges
- Exacerbation of pre-existing corneal disease
- Patient understanding
Quantifying the blur

• Keep it simple → CL-over refraction - Trial gas-permeable CL to see how much irregularity it nullifies
  ✓ Elevated anterior stromal scar
  ✓ Previous pterygium surgery
  ✓ Herpetic disease
  ✓ Salzmann’s nodular degeneration
  ✓ EBMD
  ✓ Dry eye

• Fuch’s = CCT using pachymeter, Spec microscopy for ECC
Quantifying the blur 2

Others may be more helpful for corneal oedema and deeper corneal pathology

- HD Analyzer – Laser optical quality analysis - assess image quality reduced caused by anterior segment (tear film, cornea, lens) vs. keratographs (dry eye analysis)
- Irregularity using topography
- Irregularity index with tomography (Pentacam)
- Higher order aberrations using wavefront aberrometry
  → iTrace – blur from cornea vs lens
- Lens density with pentacam (PNS)
LOCS III
N01NC1 cataract

Shetty et al, 2016
What - 7 Key Challenges

1. Prior Refractive Surgery
2. Grafts
3. Fuch’s Dystrophy (*protecting the endothelium*)
4. An unhealthy Ocular Surface (*protecting the epithelium*)
5. Keratoconus and other ectasias
6. Herpes Infections
7. Corneal Scarring/Opacity (*protecting the stroma*)
1. Prior Refractive Sx – Pre-op

- Machines measure outside central area and extrapolate values
- Make assumptions regarding contribution of posterior corneal surface
  → Both no longer hold true after refractive surgery

Look for agreement between biometer (IOL Master/Lenstar), topography (pentacam) and subjective or auto refraction Ks, or even manual Ks
- When not in agreement
  → Go for biometry Ks
  → OR choose lowest K values → will calculate slightly higher IOL power for mild myopia

Use ASCRS calculator
1. Prior Refractive Sx – RK

1. Clear corneal vs scleral tunnel
   - Avoid cuts
     → main wound clear corneal only if few cuts and more central
     → Sideport OK

2. Surgical Aim
   - Greater influence of corneal oedema with flattening (hydration of incisions)
   - Aim for myopia around -2D → hyperopic shift occurs after surgery for 3-4/12 due to oedema
   - Delayed change in spherical equivalent in first 1-2 weeks
1. Prior Refractive Sx – RK Video
2. Prior Graft

Key issues

1. Visualisation
2. Corneal fragility – both epi and endo sensitivity
3. Potential increased risk of rejection
4. Pre-op Astigmatism
5. Careful wound closure
2. Prior Graft - Visualisation

- Limit number of pre-operative drops if possible
- Frequent lubrication of ocular surface → BSS or dispersive visco (viscoat) with some BSS
- Avoid removal of epithelium
- Use red reflex enhancing light/coaxial light/adjust head position/microscope tilt
- Vision blue
- Beware retained fragment in angle if peripheral cornea opacified
- Note that induced myopia makes it hard to estimate depth
2. Prior Graft - Visualisation

50yo PK for KCN
Only eye
(sutures removed since photo)
R PKE/IOL last month for dense cataract

Retained lens in angle not detected until all wounds sutured
2. Prior Graft - Fragility

Epithelial fragility as per previous slide

Endothelial is never normal

→ Place dispersive viscoelastics/soft shell technique
  – deflected nuclear fragments and small bubbles can both cause damage

→ replace at regular intervals

→ Minimize phaco time (phaco chop may use less energy)

→ Phaco within iris plane or below in the capsular bag if safe to do so

Therefore, consider taking out cataract in patients with previous PK early

2. Prior Graft - Rejection

Controversial but many may have anecdotal evidence of rejection post cataract surgery

Pre-operative steroid (prednefrin Forte 1%) qid @ 1/52 to 48 hours prior

↑ to Q2H post op and wean after 4 weeks

Maintain BD up to 2 months before dropping down to usual regimen

Watch IOP closely

Avoid NSAIDs as epitheliopathy risk high for DALK/PK patients (EK patients OK)

- Exception is higher risk for CMO but use lubricants ++
2. Prior Graft – Wound Closure

Clear corneal incisions fine but frequently open post-operatively – care with wound construction

Suture ALL incisions and check for leakage

Peripheral cornea often very thin (esp. keratoconus pts) and may get pellucid-like changes in long-standing grafts

Remove at 1 week if well sealed or wait 6 weeks if concern re: thin tissue

Flat AC will knock off remaining endothelial cells

↑ risk of endophthalmitis 44x

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2. Prior Graft – Wound Closure

Wound leak after suture removal in thin cornea at 6 weeks

Suturing - 10-0 Nylon in 2-1-1 (granny and reef)
best knot morphology for ease of removal (+ minimise trauma)
and significantly smaller than other knots

Also consider wound position
- Larger graft
- Decentered graft

2. Prior Graft – Astigmatism

Biometry considerations

Toric IOLs – safest bet but will unmask astigmatism of IOL if redo graft required

Average myopic astigmatism after PK around -4D.

Mean post-transplant K’s (eg. 44D) can be used for cataract surgery before PK – difficult, therefore sequential cataract surgery after PK/DALK may be advantageous despite potential risk of endothelial cell loss

Consider sulcus toric IOL later
2. Prior Graft Video
3. Fuch’s

**Consider** cataract first vs. combined procedure:

- Significant guttae, increased pachymetry, asymmetric pachymetry, epithelial oedema
- History of **blurry morning vision** that clears → ask about what time of day it clears
- Visual demand of the patient

**CCT** – if >650 consider triple

**Cell count** – if <700 consider triple

**Exceptions to both rules** – document symptoms

- **Cataract**
  - No oedema, minimal guttae

- **Phaco alone**
3. Fuch’s

No cataract
Symptomatic FED

- Young, not presbyopic
  - EK
- Older, presbyopic
  - Phaco + EK

Cataract
Symptomatic FED

- Phaco
- Then EK

- Phaco + EK

Staged vs. combined
3. Fuch’s – Case Example
3. Fuch’s - Surgery

Vision Blue

Dispersive visco, redo often, soft-shell

Remove all of the visco – avoid IOP spikes

Reduce phaco time as much as possible

Phaco in iris plane

Beware Descemet’s detachments
3. Fuch’s – Lens Choice

Avoid multifocals

Avoid hydrophilic materials
3. Fuch’s – Lens Choice

Use torics with caution (as may need graft later)

Pre-op

Post-op

6 months post DMEK

DSAEK average post op astigmatism 1.5D
SIA mean 0.11 with range -0.4 to 0.6D (1-2mm wider than standard phaco incision)

3. Fuch’s – Surgical Aim

Aim more myopic (graft → hyperopic change due to diverging lens shape)

How much?? No consensus

-1 to -1.25 for DSAEK
-0.5 to -0.75 DMEK

DSAEK → +1.1D (range +0.7 to +1.5D)

DMEK → +0.43D (range -0.34 to +1.17D)

Schoenberg + Price et al, JCRS 2015
3. Fuch’s – VA Outcomes

**DSAEK**

Large percentage end up better than 6/12 but not all

Lower frequency of rebubbling

**DMEK**

Rapid visual recovery – some patients 6/6 by week 1, refraction stable after 3m

Visual acuity – one case series 500 cases

→ 98% ≥ 6/12

→ 52% ≥ 6/6

Peraza-Nieves et al, Cornea 2017
3. Fuch’s – Post op

- Monitor closely for IOP rise
- Watch for epithelial oedema/bullae or stromal oedema
- Increase steroids
- Hyperosmotic agents (NaCl 5% may expedite deturgescence)
4. Unhealthy Ocular Surface

Difficulties:
- Lack of cure!
- Higher demand patients
- The cause of blur
- Biometry – drops, use more than one method and compare consistency
4. Unhealthy Ocular Surface

Treat pre-operatively

- Aqueous deficiency consider punctal occlusion/cyclosporine (time to work, 0.05% daily)
- Lid margin = lid hygiene +/- antibiotics, systemic doxy etc
4. Unhealthy Ocular Surface

**Treating intraop**

Care with opening speculum only as much as necessary to avoid lagophthalmos and exposure post-op due to flaccid older lids that don’t recover as well from stretching trauma.

Choice of wound location

- Scleral tunnel in Mooren’s, PUK to minimise melt
- Clear corneal incision in previous scleritis, RA, SJS as scleral insult trigger inflammatory cascades

Terriens – DM detachment not uncommon

Others:

- Light filters, decreasing exposure, time, proper irrigation/visco on surface, soft manipulation of ocular surface, limiting wound size as best as possible to reduce damage to corneal nerves

4. Unhealthy Ocular Surface

**Post-op**

- Betadine kills goblet cells, thereby leading to dry eye or worsening blepharitis/MGD in post-operative period

- Avoid preservatives in eye drops, or prolonged use of eye drops (stop or taper when no longer required)
4. **Severe** ocular surface disease (GVHD, SJS, OCP/MMP)

Sterile corneal melts

Optimise surface imperative

Surgery postponed until inflammatory component fully controlled and disease activity markedly reduced

Clear corneal incisions

**Peri-op immunosuppression:**

Chronic GVHD aggressive lubrication sufficient for surgery

Others (OCP/MMP, SJS) → perioperative systemic immunosuppressive therapy may be required

- Control disease for minimum 1 YEAR after cataract surgery
5. Ectasia

Optical biometry OVER estimates corneal power and UNDER estimates IOL target power → Post-operative hyperopia

Discontinue contacts as long as required
- Aim to have two consecutive visits with consistent manifest refraction and topography maps

Reduce astigmatism
- Keratome incision on steep axis to reduce regular astigmatism
- Toric IOL appropriate if regular astigmatism and stable
- Also consider asphericity of lens choice

CXL
- If younger patient, consider cross linking to stabilise before operating

Choice of 2 IOLs – go for higher

Asphericity (Q-value)

The curvature of an ellipsoid — whether prolate or oblate — can be expressed through an asphericity quotient called the Q-value.

<table>
<thead>
<tr>
<th>Prolate ellipsoid</th>
<th>Oblate ellipsoid</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Q = -2$</td>
<td>Severe keratoconus, -5 D PRK</td>
</tr>
<tr>
<td>$Q = -1$</td>
<td>Mild keratoconus, +2 D PRK</td>
</tr>
<tr>
<td>$Q = -0.52$</td>
<td>No spherical aberration</td>
</tr>
<tr>
<td>$Q = -0.26$</td>
<td>Normal</td>
</tr>
<tr>
<td>$Q = 0$</td>
<td>Spherical</td>
</tr>
<tr>
<td>$Q = +1$</td>
<td>8-cut RK, -5 D PRK</td>
</tr>
<tr>
<td>$Q = +2$</td>
<td>16-cut RK, -12 D PRK</td>
</tr>
</tbody>
</table>

Source: Holladay JT

Thebpatiphat et al. Eye 2007;33:244-6
5. Ectasia – Contact Lenses

More than 50% still require RGP lenses post-op

Removal of contact lens before biometry

Avoid toric lenses if:
- Happy RGP wearer – toric will unmask lenticular iatrogenic astigmatism post op

Use toric if:
- Not too irregular
- Ectasia stable
- K methods in agreement and also match refraction
- Reasonable spectacle-corrected VA pre-op

→ Advise patient won’t be able to wear RGP

→ Counsel if >25mm AL or >12.5mm WTW or high myopia, ↑ risk toric IOL rotation (Use CTR)

Alio JL et al BJO 2014
5. Ectasia - Surgery

Tend to have longer AL and deeper AC (therefore different ELP)

Bozorg et al → Stratified groups

- Mild < 48D
- Mod 48-55 D
- Severe > 55D

Found eyes with larger measured Ks = greater predictive error

Patient has keratoconus (KCN) and cataract requiring surgery

- No
  - KCN Stable?
    - No
      - Corneal cross-linking to stabilize
    - Yes
      - Repeatable biometry measurements?
        - No
          - Consider intrastromal corneal ring segment for further stabilization
        - Yes
          - Severity of KCN?
            - Mild K<48D
              - Use actual K value for IOL calculations with target of low myopia
            - Moderate 48-55D
              - Use standard K value for IOL calculations with target of low myopia
            - Severe K >55D
              - Axial length <25mm? White to white <12.5mm?
                - Yes
                  - Toric or Monofocal IOL
                - No
                  - Consider capsular tension ring if toric IOL placement planned
                  - 43.25D
                    - Aim +1.0
                      - AIM +1.5
                        - AIM -1.8
                          - AIM -1.8
                            - Recommend placement of monofocal IOL
                            - Do not place toric IOL if planning on use of RGP or scleral lens after surgery

6. Herpetic Infections

Still no good data on what works best peri-operatively for prophylaxis

Depends on:
- Active disease developed despite prophylaxis previously (Aciclovir resistance)
- Degree of inflammation
- Previous site of infection (severe inflammation, iritis, necrotising stromal keratitis)

**Stromal disease/Iritis**
- PO VCV 500mg TDS 2 days prior, then 2 weeks post op
- Can also add topical acyclovir or ganciclovir 0.15% gel

**Epithelial ulcers**
- Topical ganciclovir or acyclovir 1-2 days pre-op and 2/52 post op

Note: recurrences post-op are typically not dendritic and may be difficult to Dx – therefore any PED should be suspect
7. Corneal Scarring/Opacity

Is it correctable?

- Topography may show irregular astigmatism – limits IOL options and makes selection difficult
- Remove first with Superficial keratectomy (As may diminish contrast sensitivity)
- Try EDTA if band K
- PTK for anterior stromal scars, EBMD etc

Post-Pterygium – topography (wait 2 months at least for healing – same for Salzmann)
7. Corneal Scarring/Opacity

PRE-OP

- Care with biometry as impedes incident rays for laser interferometry
- Consider conventional ultrasound biometry to measure axial length (beware operator error)

Contraindication to advanced technology IOLs
7. Corneal Scarring/Opacity

INTRA-OP

- Visualisation
  → Smaller scars as per previous (mag up, change intensity/direction light, position head etc)
  → Larger scars – Chandelier illumination, endoilluminator from outside or through sideport
  → Initiate manoeuvres in clearer areas
- If not safe to do capsulorhexis – consider combined
7. Corneal Scarring/Opacity

Initiate rhexis from clear zone
7. Corneal Scar - Zepto
Thankyou!

Clinical photos obtained from RVEEH Medical Photography unless indicated