Keratoconus – part 2

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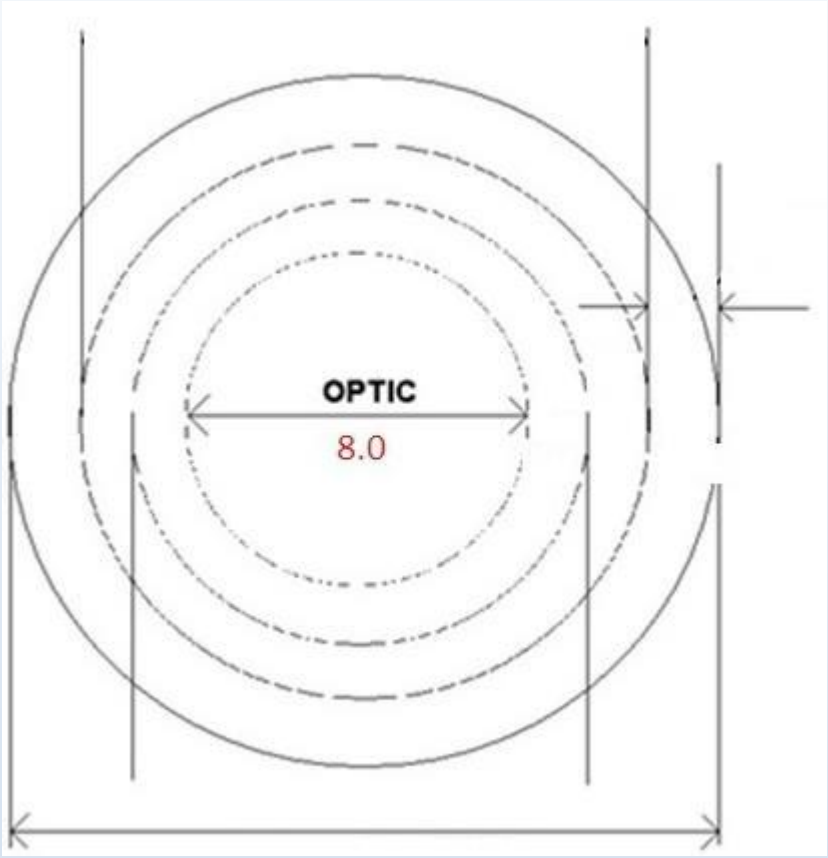
RGP Parameters

- BOZR (back optic zone radius), BC (base curve)
- OD (overall diameter), TD (total diameter)
- BOZD (back optic zone diameter, OZ (optic zone)
- BPR (back peripheral radii), periphery, peripheral curves
- BPCD (back peripheral curve diameter), peripheral curve widths
- Asphericity
- Power
- Material
- Centre thickness

RGP Parameters

- **BOZR (back optic zone radius), BC (base curve)**

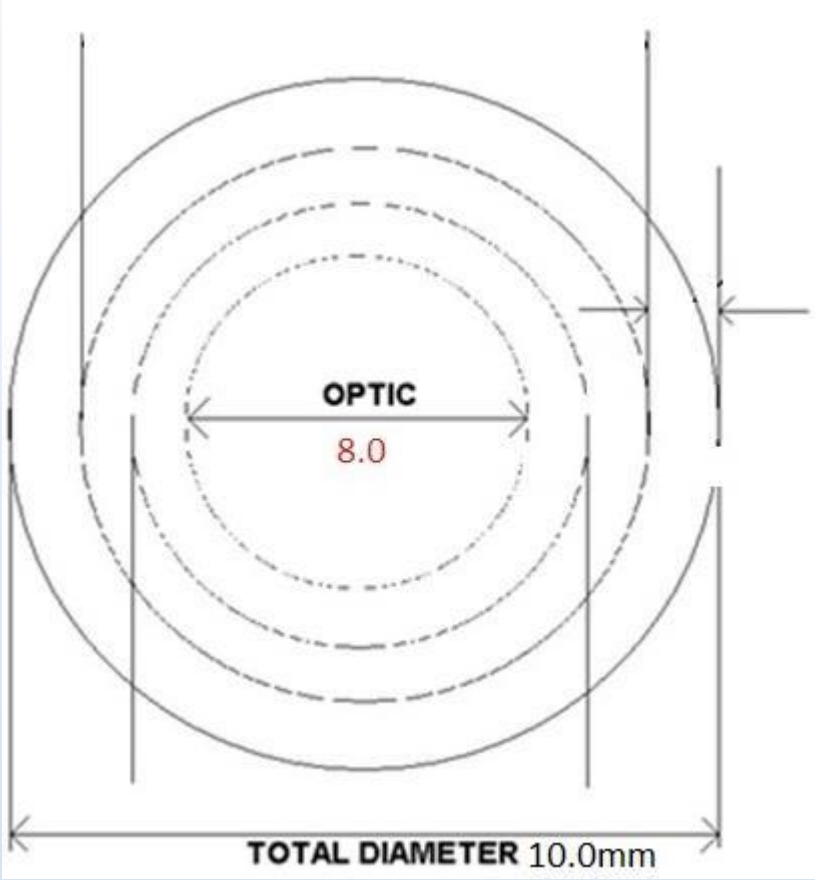
  8.0 (10.0), Optic: 7.0, periphery: 8.5 (8.0), 9.5 (9.0), 11.0 (10.0)



RGP Parameters

- **OD (overall diameter), TD (total diameter)**

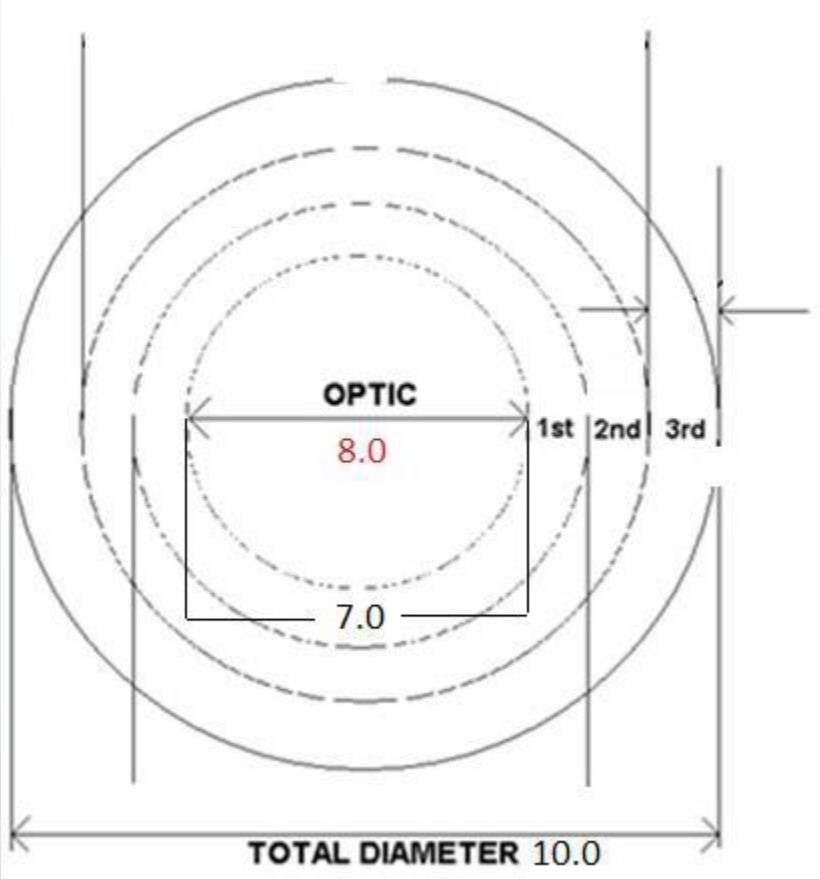
  8.0 **(10.0)**, Optic: 7.0, periphery: 8.5 (8.0), 9.5 (9.0), 11.0 (10.0)



RGP Parameters

- **BOZD (back optic zone diameter), OZ (optic zone)**

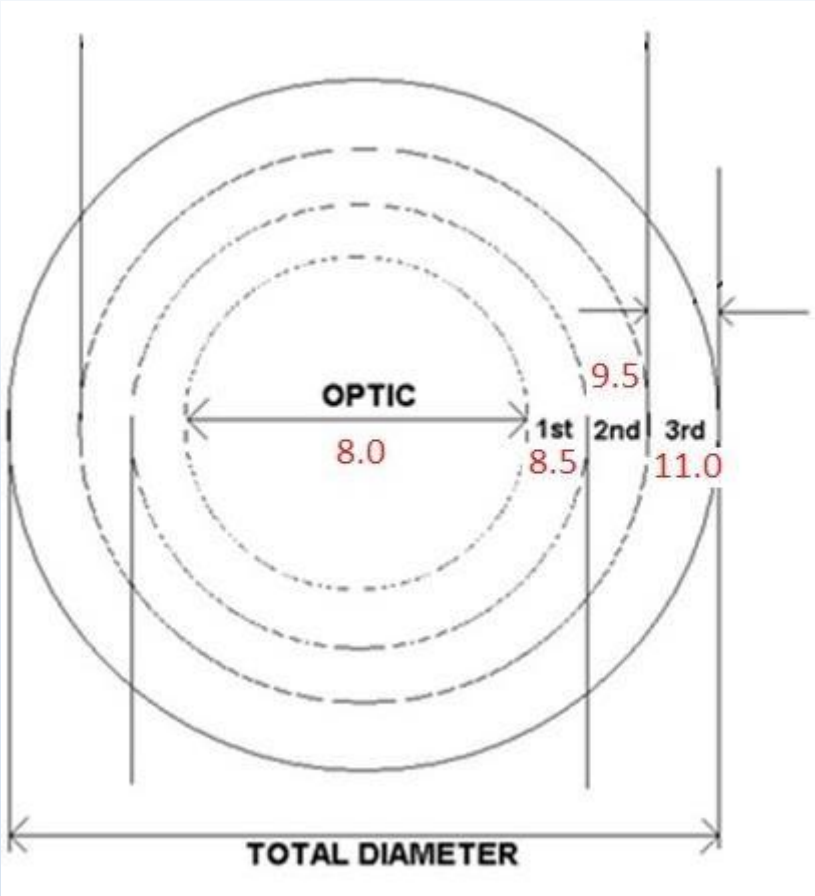
  8.0 (10.0), **Optic: 7.0**, periphery: 8.5 (8.0), 9.5 (9.0), 11.0 (10.0)



RGP Parameters

- **BPR (back peripheral radii), periphery, peripheral curves**

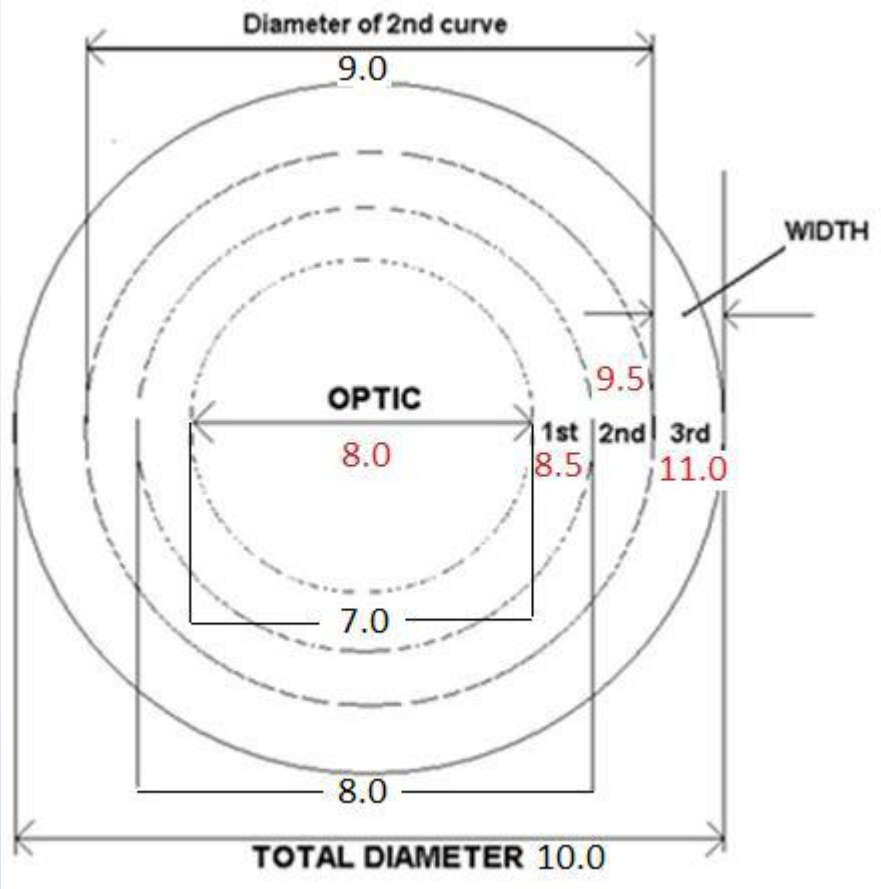
  8.0 (10.0), Optic: 7.0, periphery: **8.5** (8.0), **9.5** (9.0), **11.0** (10.0)



RGP Parameters

- **BPCD (back peripheral curve diameter), peripheral curve widths**

  8.0 (10.0), Optic: 7.0, periphery: 8.5 **(8.0)**, 9.5 **(9.0)**, 11.0 **(10.0)**



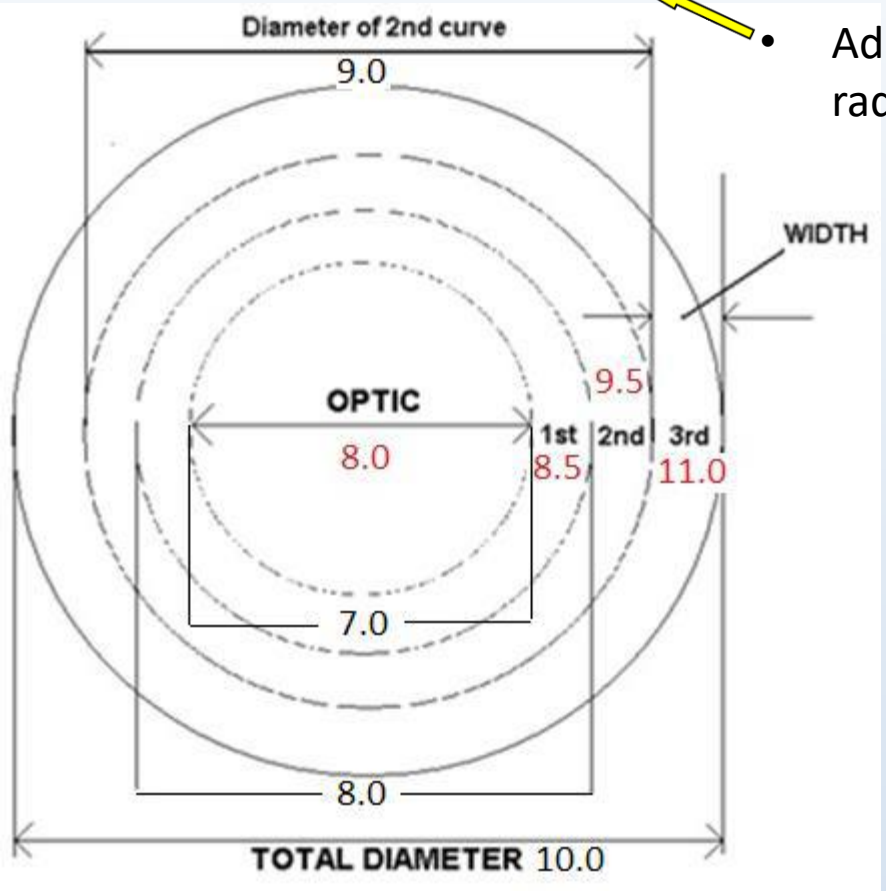
RGP Parameters

- **Specifications are identical**

8.0 (10.0), Optic: 7.0, periphery: **8.5** (8.0), **9.5** (9.0), **11.0** (10.0)

8.0 (10.0), Optic: 7.0, periphery: **+0.5** (8.0), **+1.5** (9.0), **+3.0** (10.0)

- Add to back central optic radius

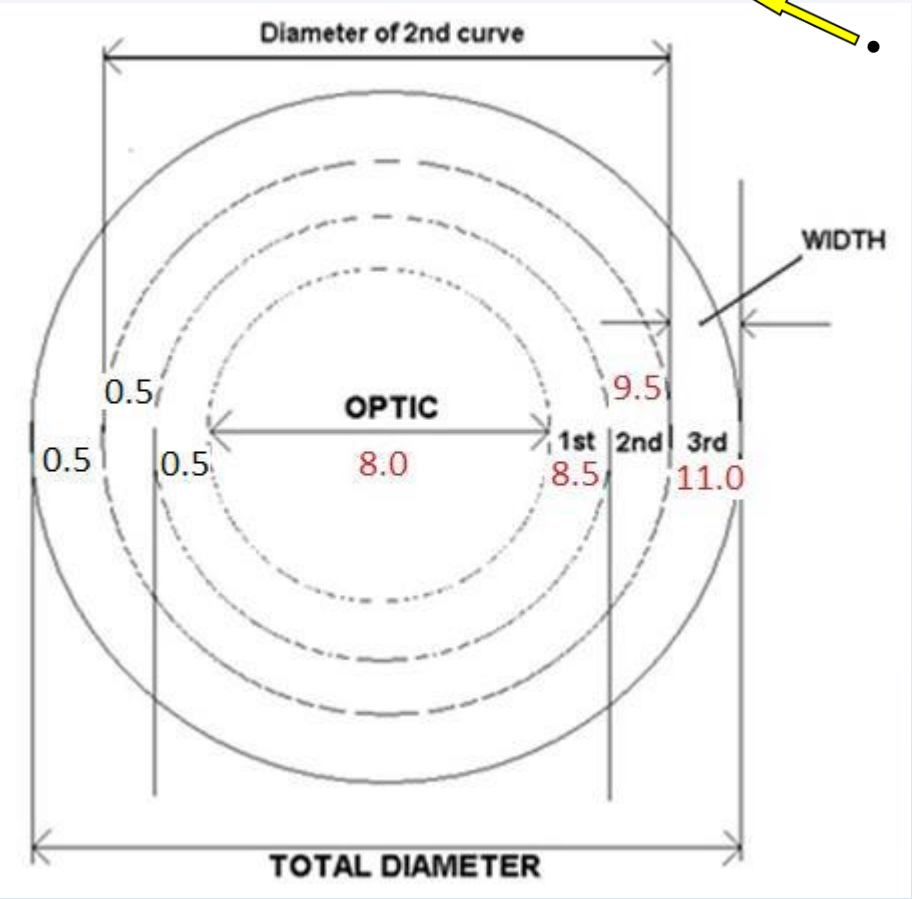


RGP Parameters

- **Specifications are identical**

8.0 (10.0), Optic: 7.0, periphery: +0.5 **(8.0)**, +1.5 **(9.0)**, +3.0 **(10.0)**

8.0 (10.0), Optic: 7.0, periphery: +0.5 **(0.5)**, +1.5 **(0.5)**, +3.0 **(0.5)**



- Add to previous peripheral curve width

RGP Parameters

- **Trial sets**
  - Knowledge of trial set specifications – peripheral curve diameters and widths give an opportunity to order modified parameters
  - example – **Australian Contact Lenses Kera trial lens set**
    - BOZR >7.0, +0.50 (0.5), 8.5 (0.3) 12.0 (0.3)

      >6.5, **+0.70** (0.5), 8.5 (0.3) 12.0 (0.3)

      >6.0, **+0.90** (0.5), 8.5 (0.3) 12.0 (0.3)

      >5.7, **+1.10** (0.5), 8.5 (0.3) 12.0 (0.3)

      <5.7, **+1.30** (0.5), 8.5 (0.3) 12.0 (0.3)
- As BOZR decreases, **rate of peripheral flattening** also increases

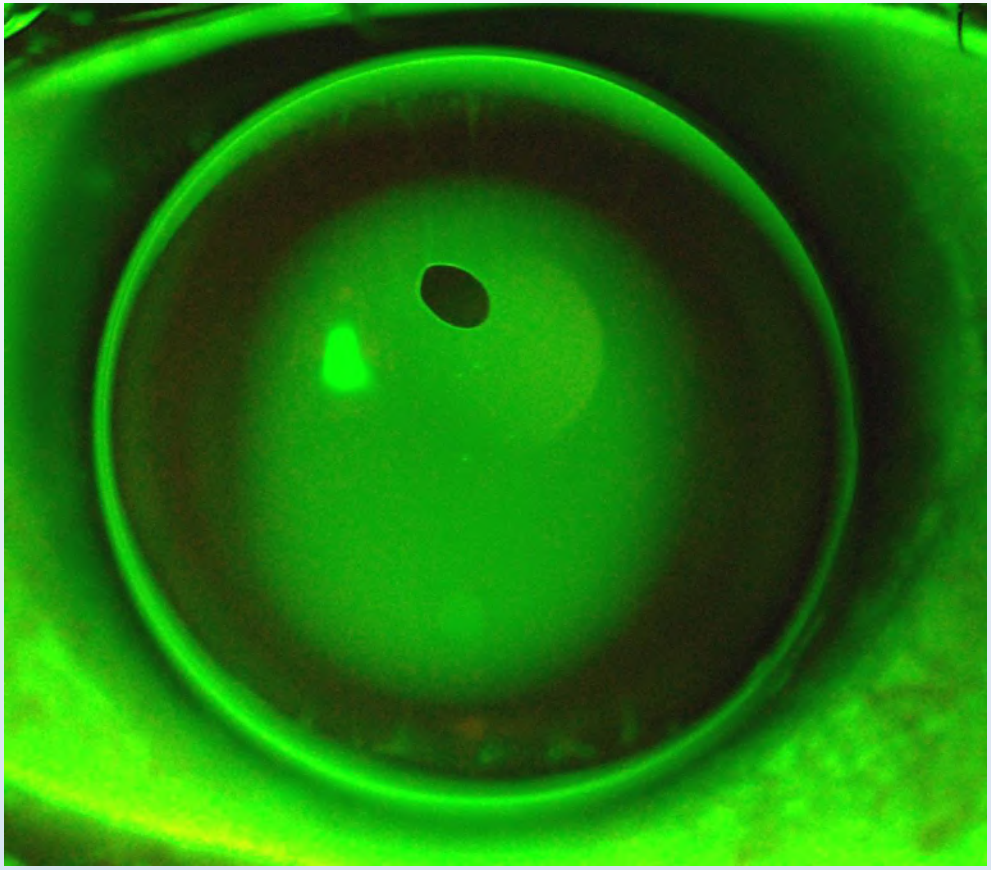
RGP Fitting

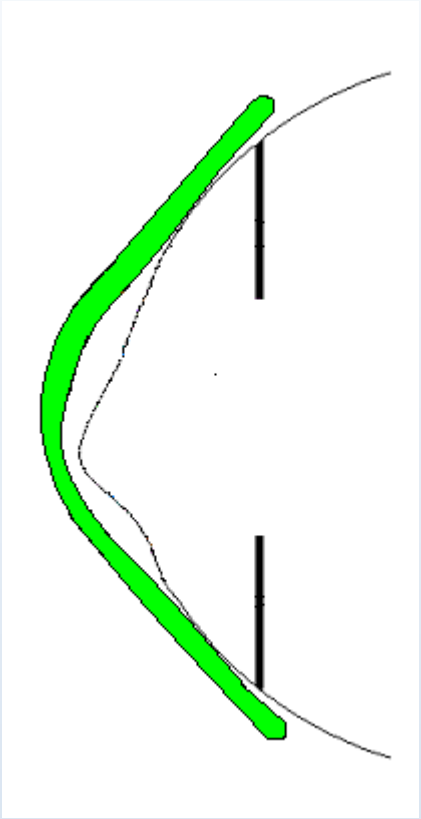
Three main designs

- Apical Clearance
- Feather clearance (Three Point Touch)
- Apical bearing

RGP Fitting

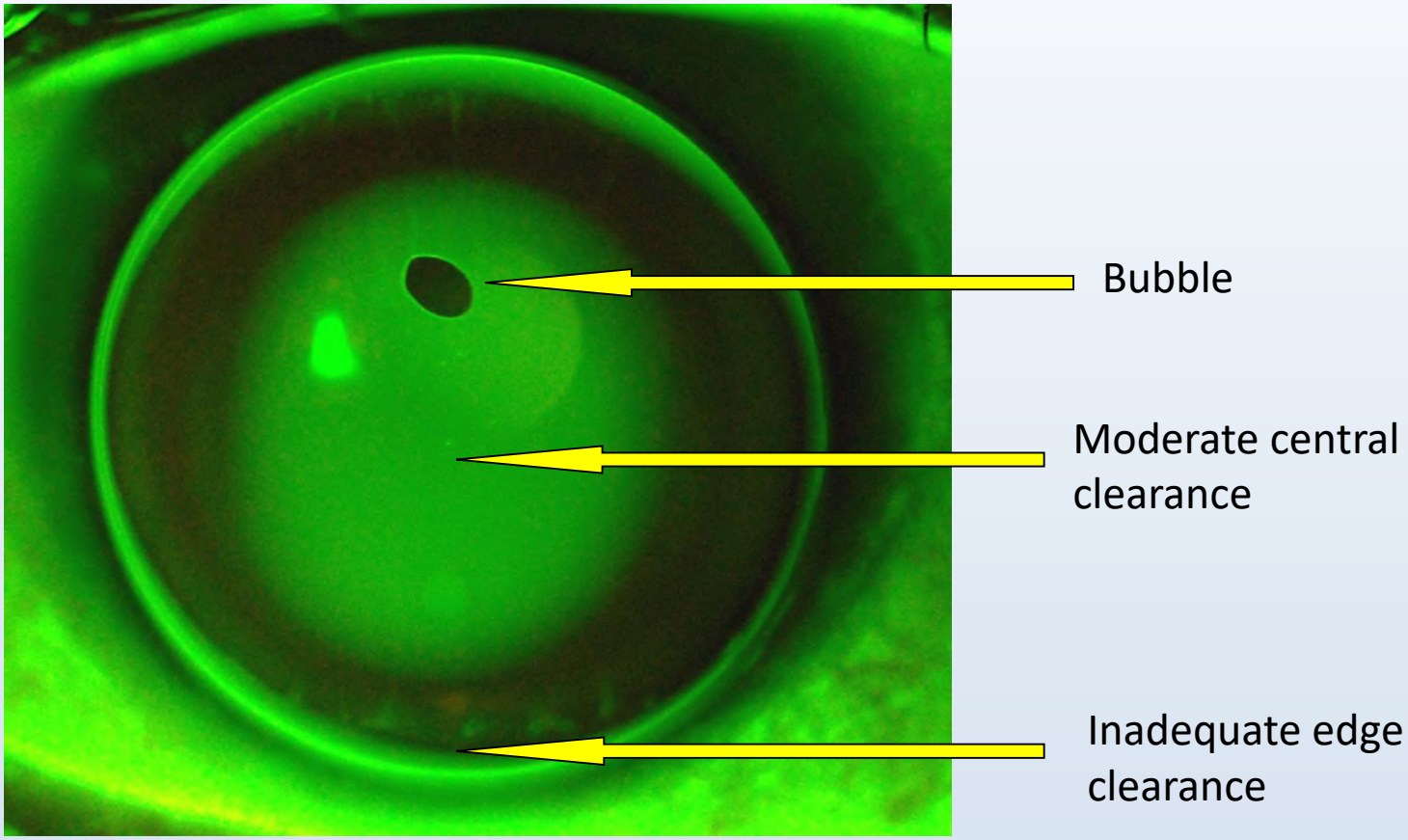
- **Apical Clearance**





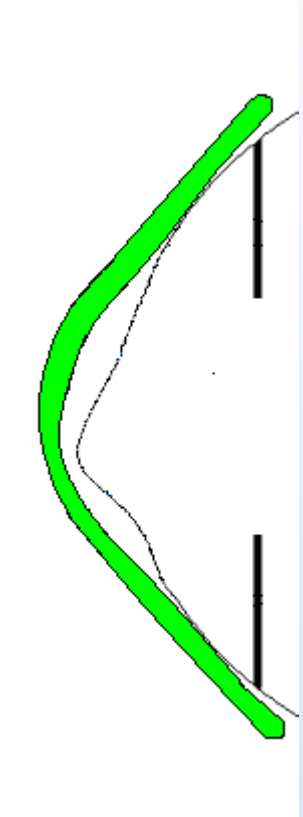
RGP Fitting

- **Apical Clearance**



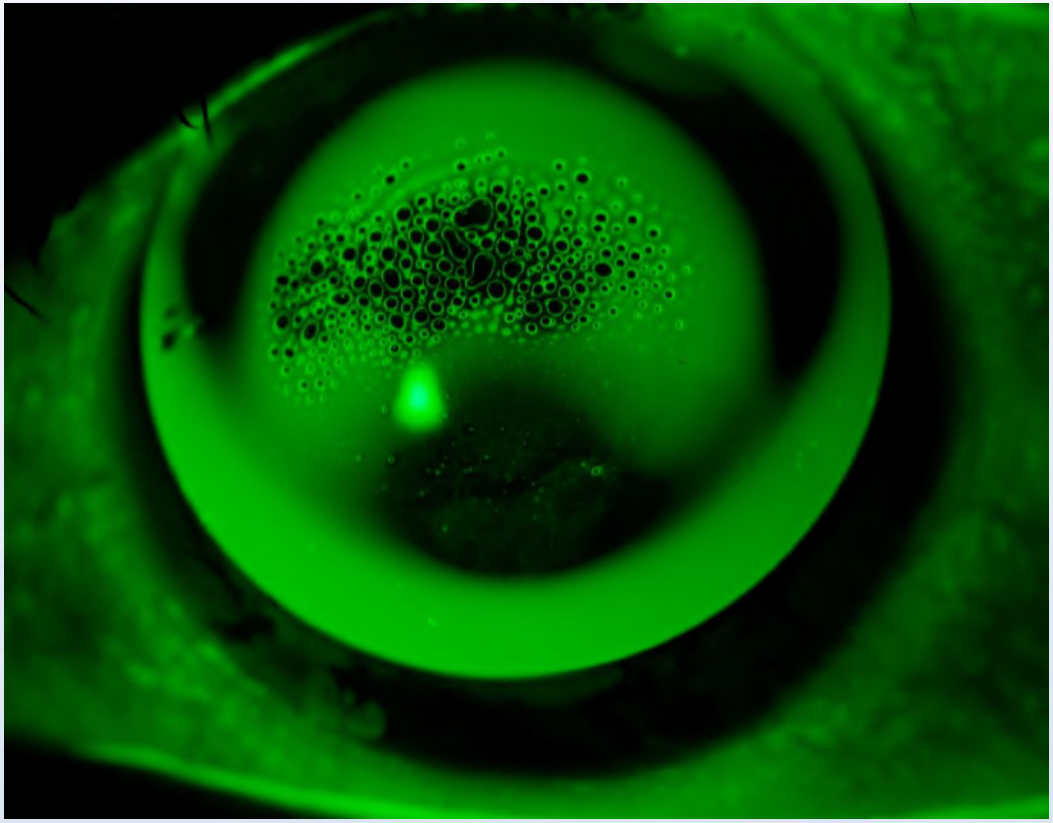
RGP Fitting

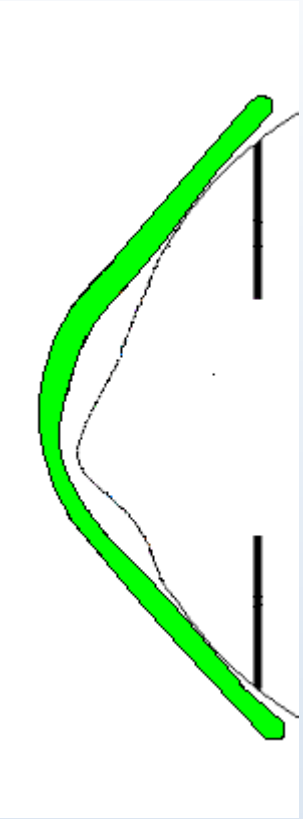
- **Apical Clearance**
  - Central curve vaults the steepest part of the cone
  - Minimises the likelihood of scarring, central staining
  - May have reduced acuity due to lens flexure after blinking
  - Tear Film Thickness (TLT) >90 µm may develop dimple veiling
  - Steep central curve may allow excessive moulding of the
  - thin cornea
  - Steeper lenses may seal off the periphery and reduce tear exchange with reduced wearing times and comfort



RGP Fitting

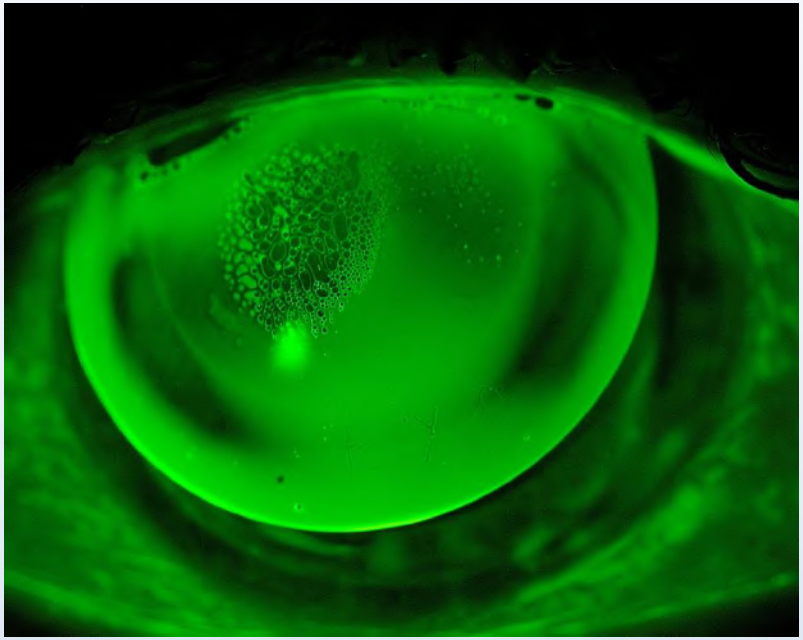
- **Apical Clearance**

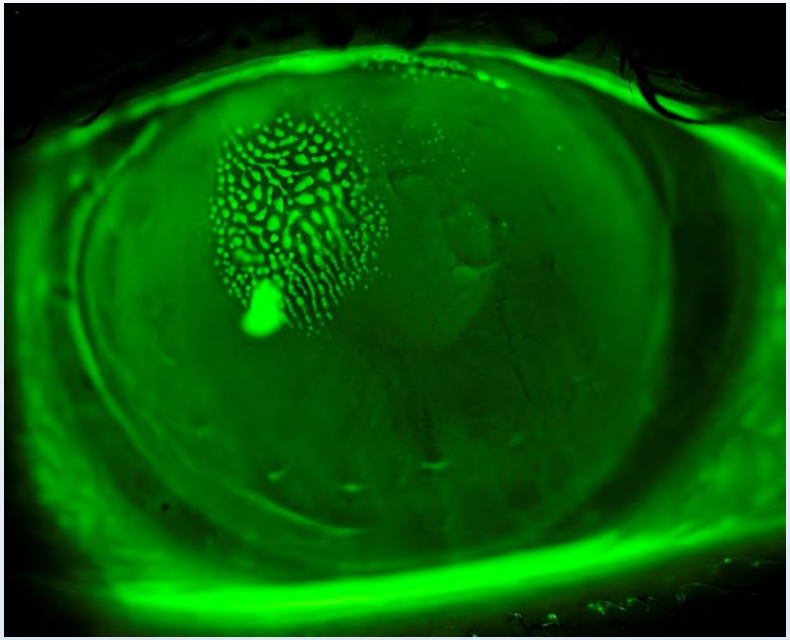




RGP Fitting

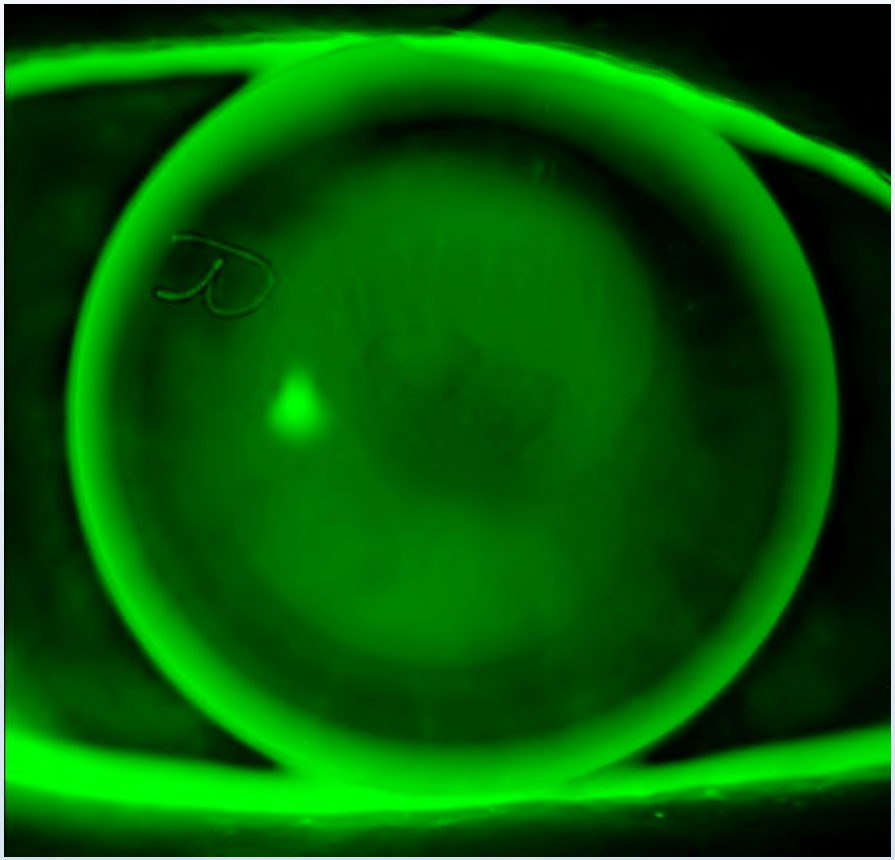
- **Apical Clearance**

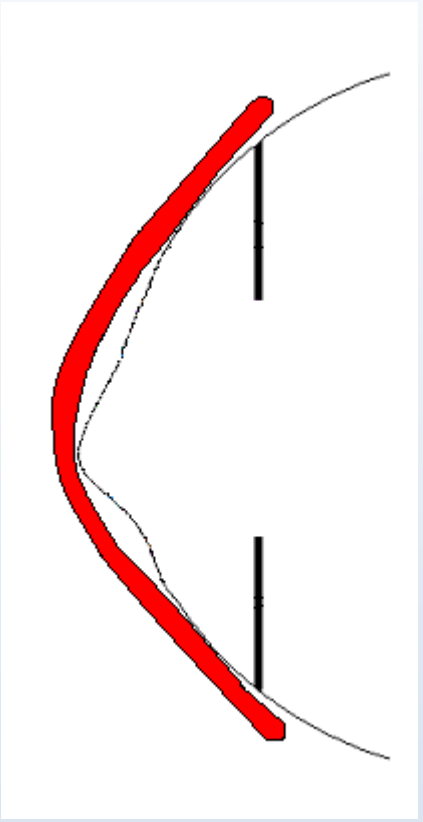




RGP Fitting

- **Feather Clearance (Three Point Touch)**





RGP Fitting

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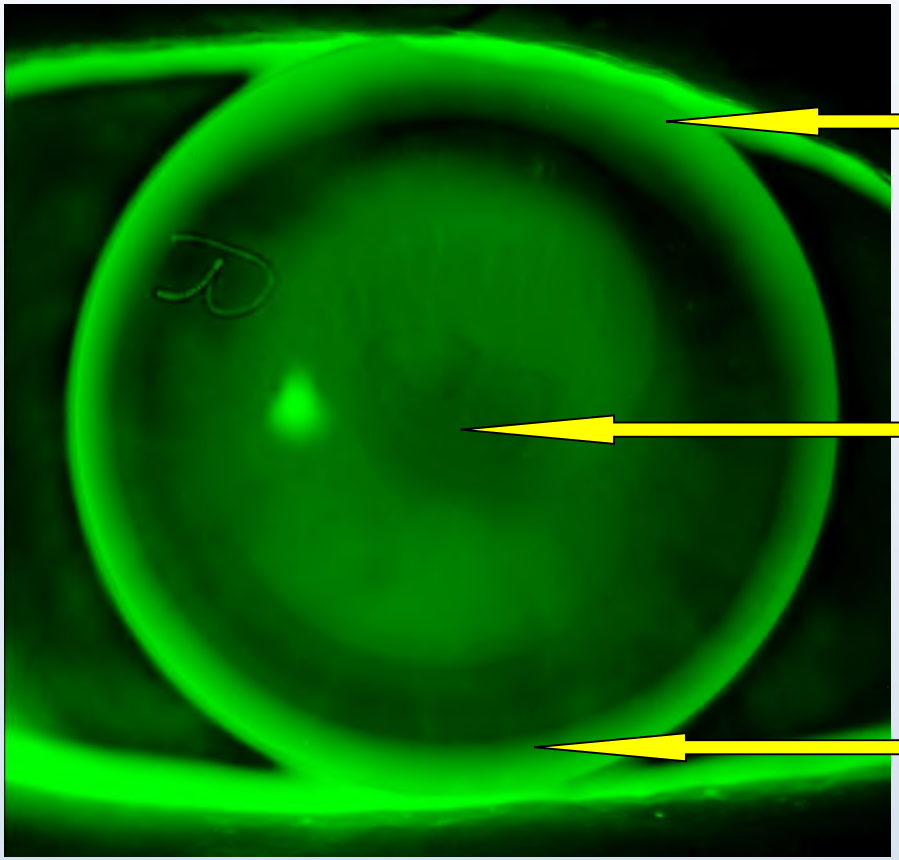
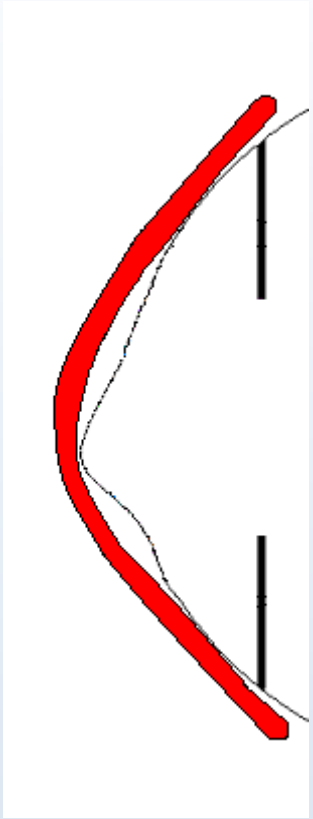


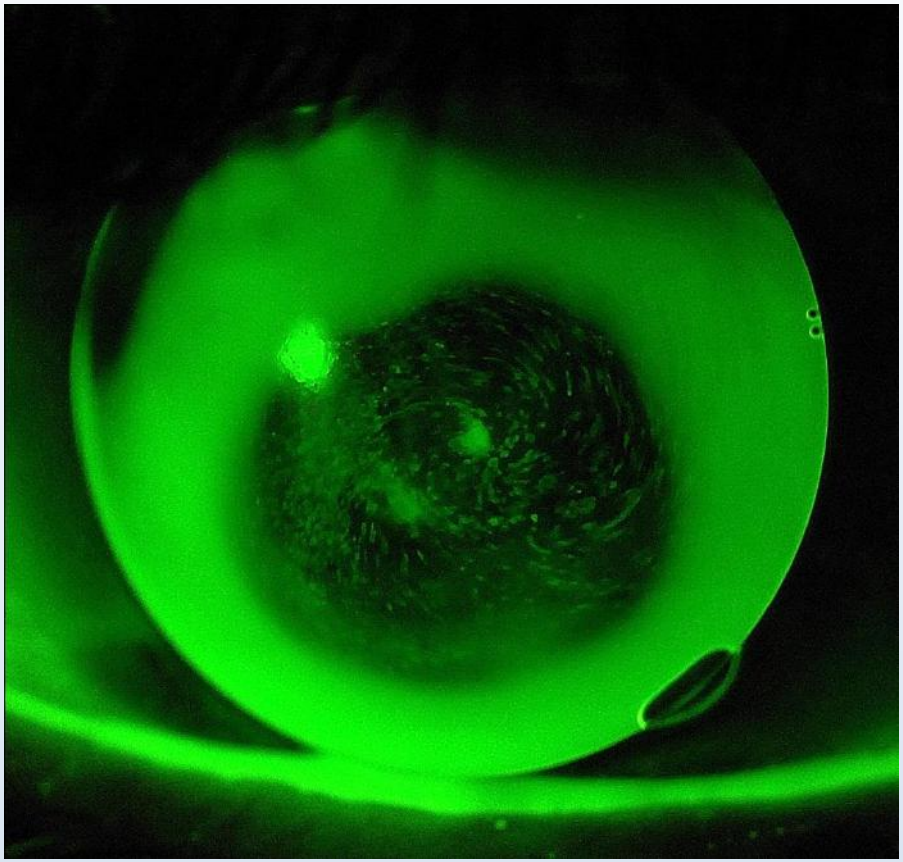
RGP Fitting

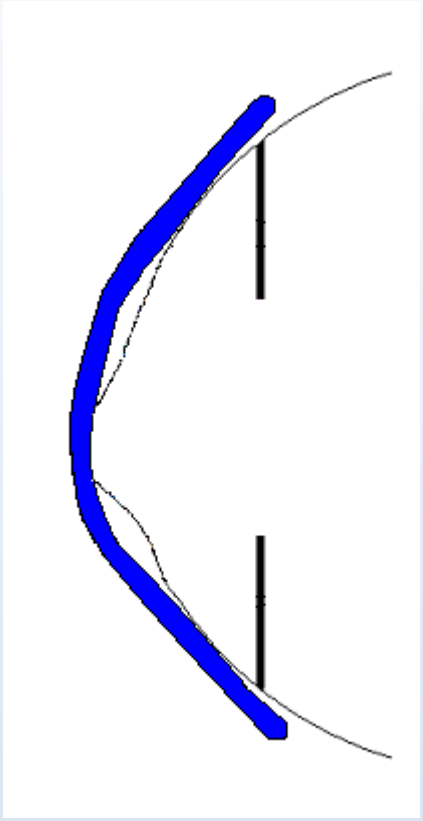
- **Feather Clearance (Three Point Touch)**
  - Attempt for minimal clearance above the steepest part of the cone
  - Minimises mechanical stress to the cone and epithelium
  - Minimises possibility of dimple veiling
  - Flatter base curve minimises corneal moulding
  - Reduced central clearance minimises lens flexure and creates good vision



RGP Fitting

- **Apical Bearing**





RGP Fitting

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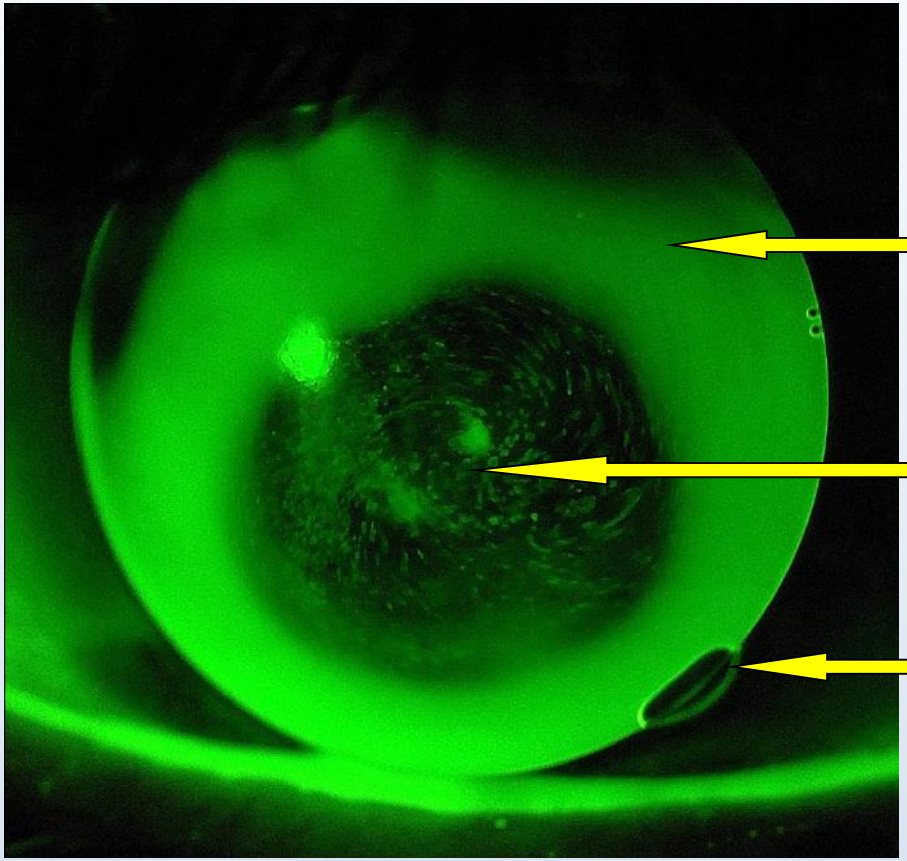

RGP Fitting

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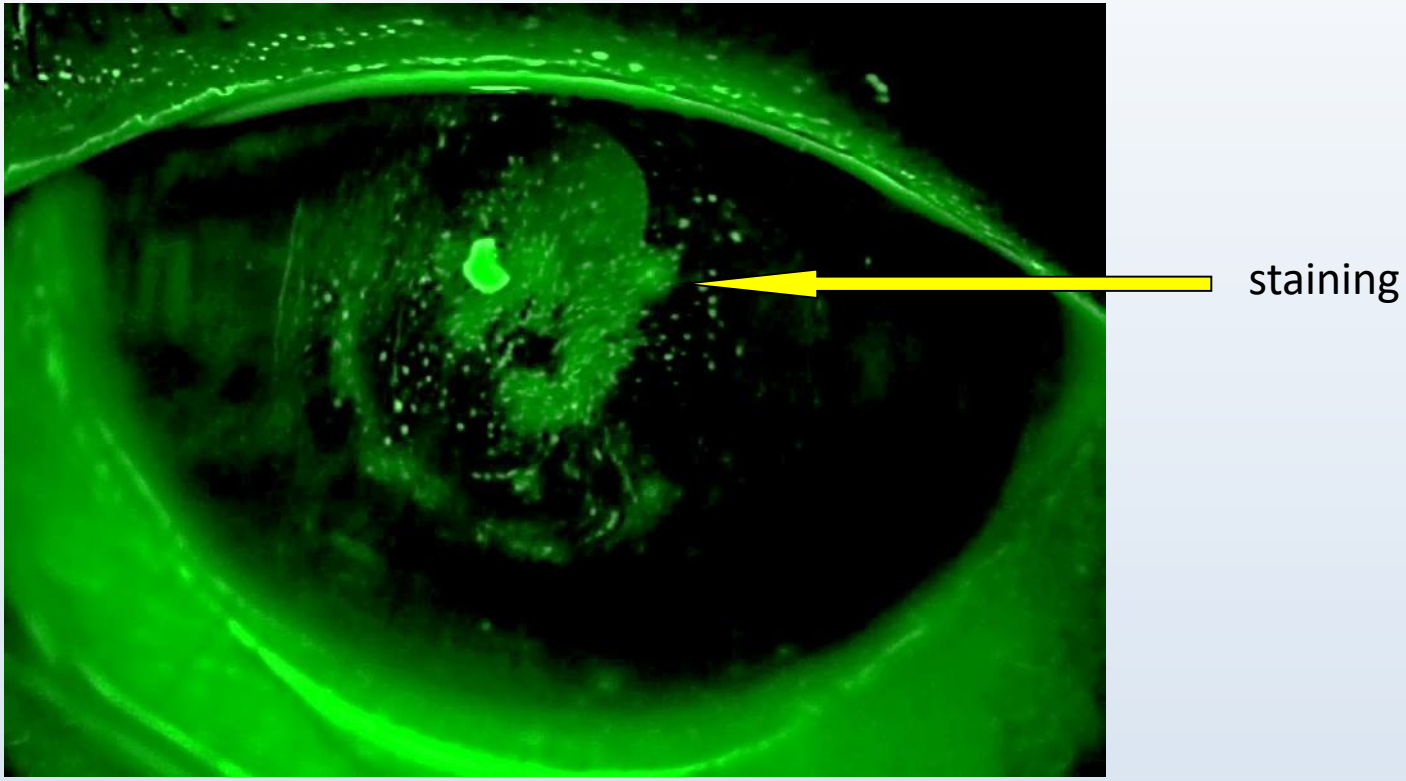
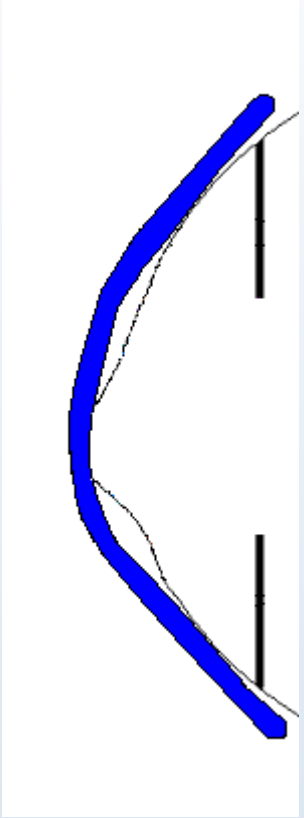


RGP Fitting

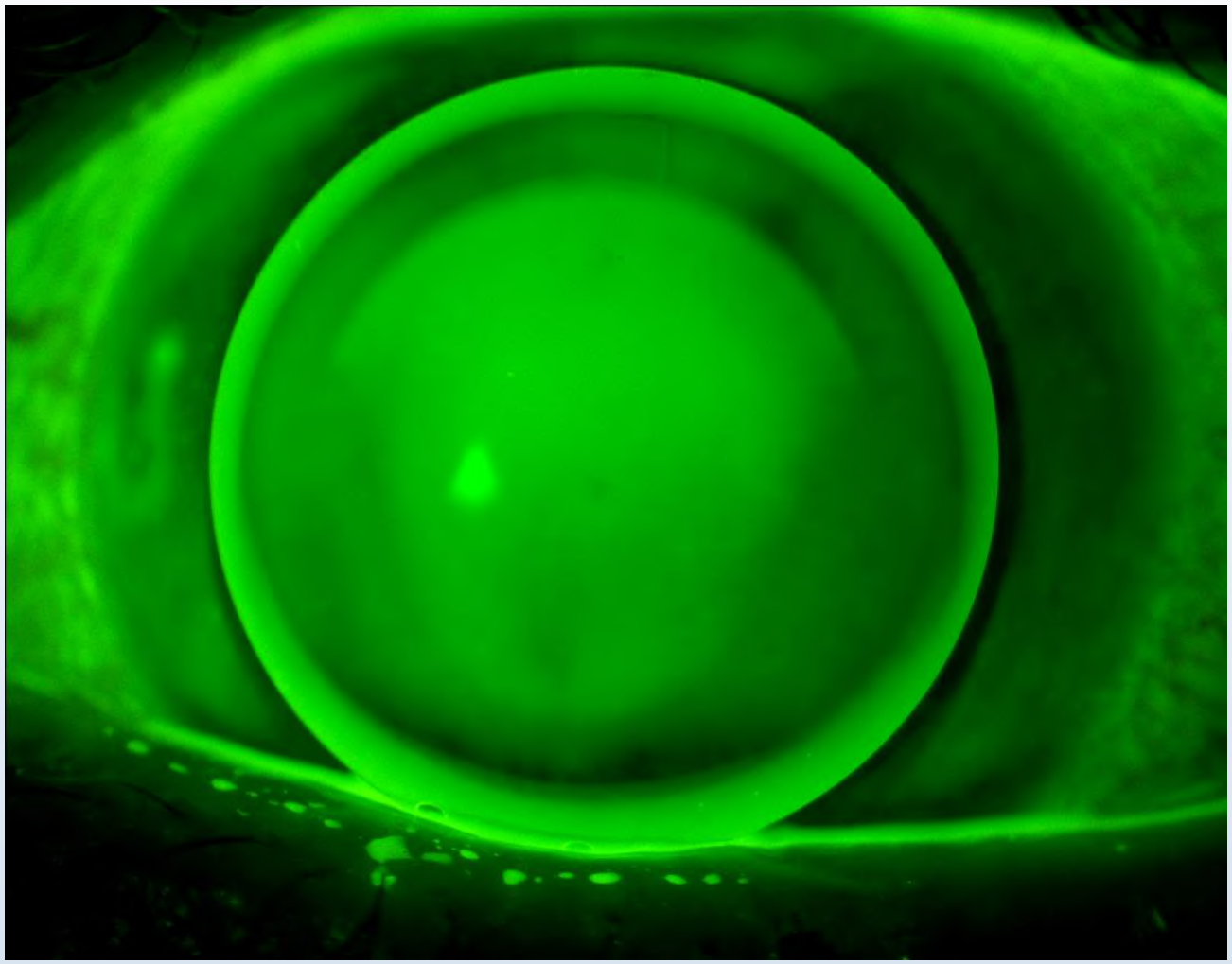
- **Apical Bearing**
  - Substantial bearing on the cone
  - Greater likelihood of significant epithelial staining on the cone – increased risk of scarring
  - “therapeutic treatment” - misconceived concept of retarding progression of keratoconus or “holding the cornea in place” with pressure
  - Occasionally better visual acuity due to hard bearing



RGP Fitting

- **CENTRE, CENTRATION, EDGE – C C E**
  - **Centre -** Feather clearance centrally (20 – 30 µm)
  - **Centration -** Central fitting (lid attachment if possible)
  - **Edge -** Adequate edge clearance – the width of the fluorescein pattern, ideally 0.5mm (70 – 90 µm deep)

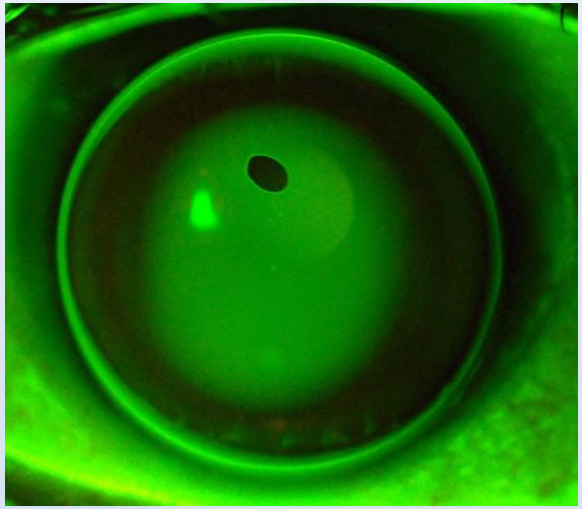
RGP Fitting

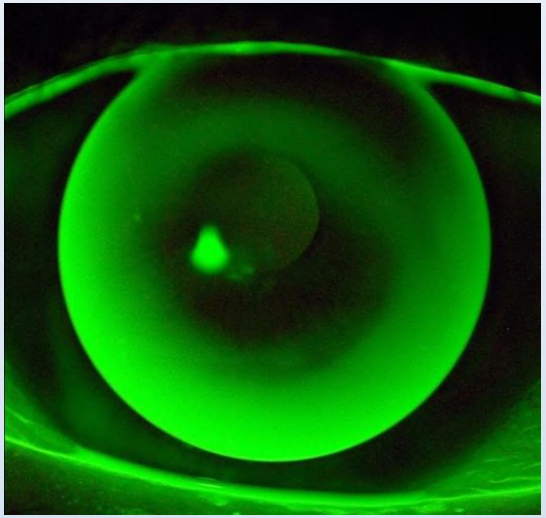


RGP Fitting

- **Back Optic Zone Radius (Base Curve)**
- Start with 0.2mm steeper than the average of the K readings.

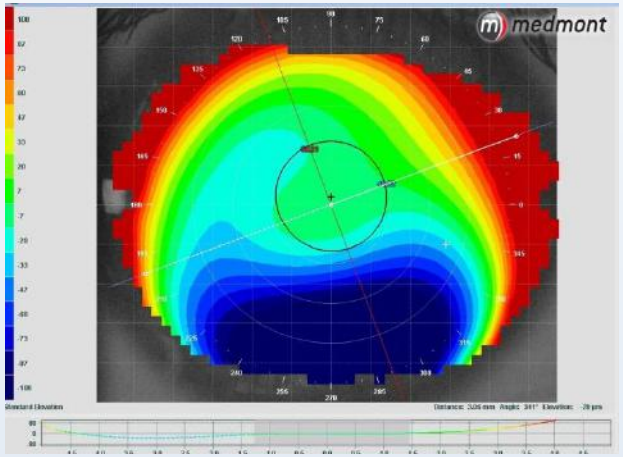
  K 6.5/5.6 – av: 6.05mm try 5.8mm BOZR trial lens
- Start with 9.0mm Overall diameter, assess central fitting
- If obvious central clearance, then go flatter in large steps (0.3 – 0.4 mm) until there is slight central touch, then 0.1 mm steeper

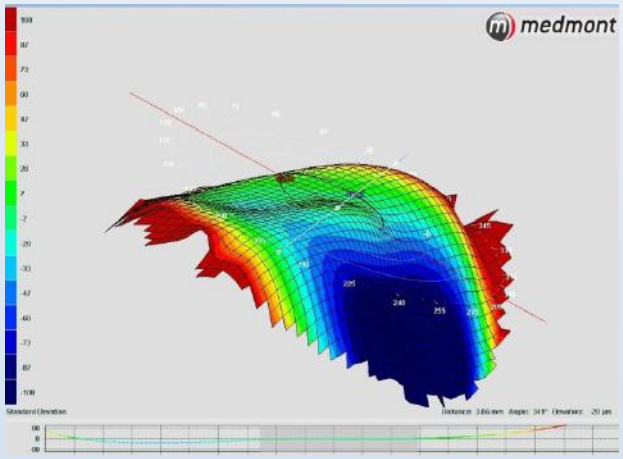


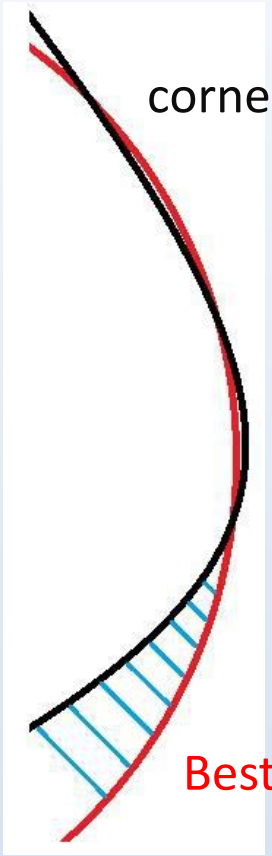


Signs of Keratoconus

- **Corneal topography** - Elevation map – height (µm) in front or behind a reference sphere or best fit sphere







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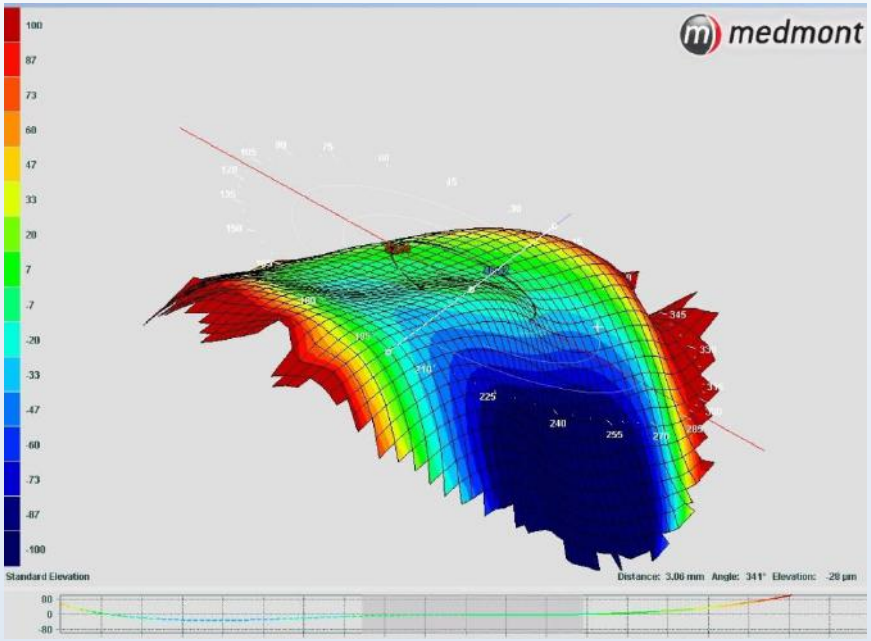
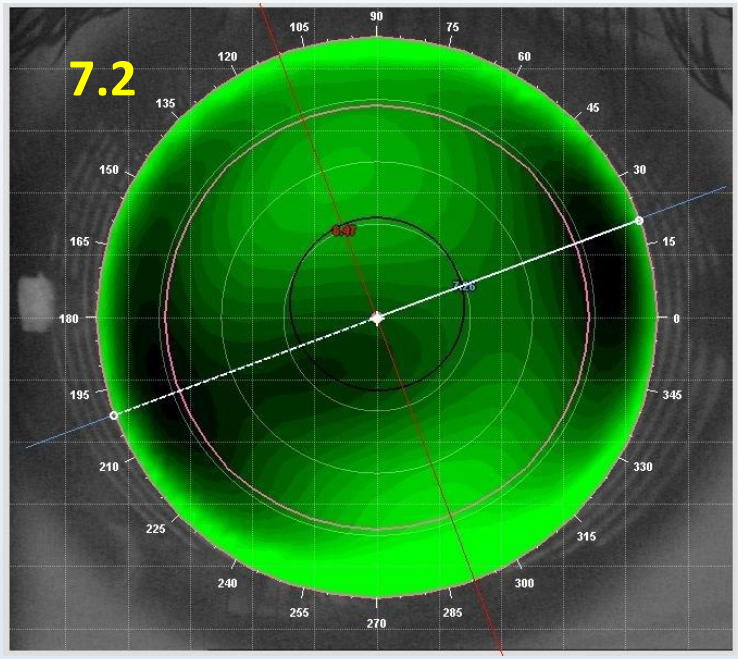




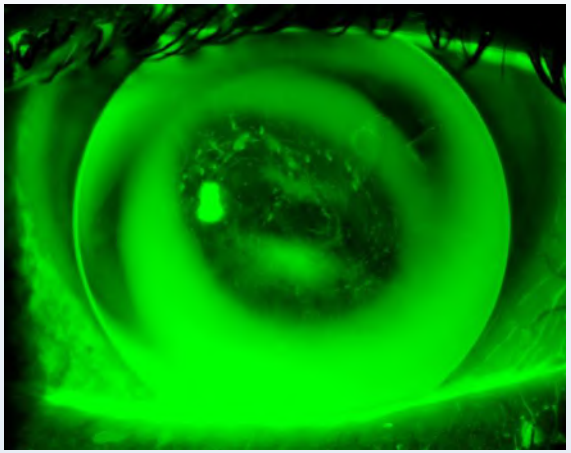
K readings 7.3 x 6.5, K's recommend 6.7 (0.2 steeper than average)

Elevation map – best fit sphere - 7.3mm, topographer program 7.2

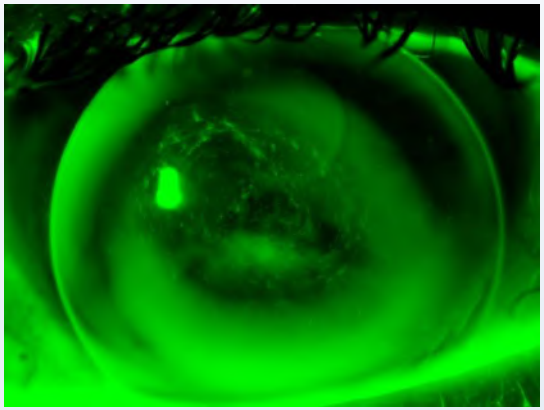
RGP Fitting

- **Back Optic Zone Radius (Base Curve)**

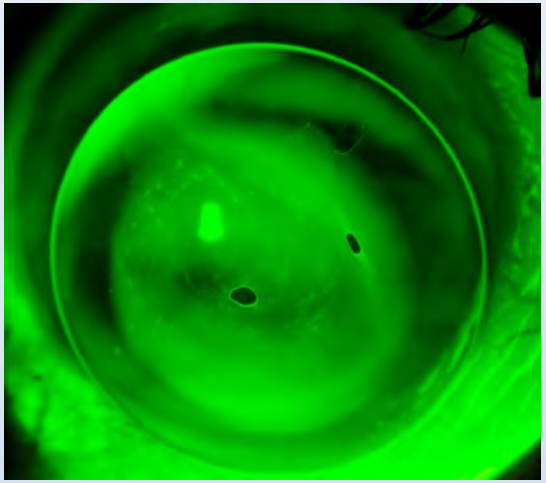
7.3(10.10)
Marked central bearing



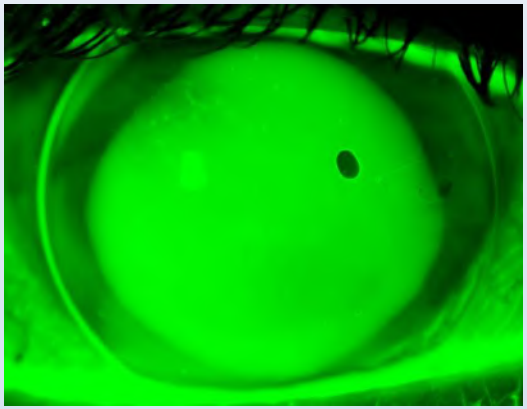
7.0(10.10)
Moderate central bearing



6.8(10.10)
Slight central clearance

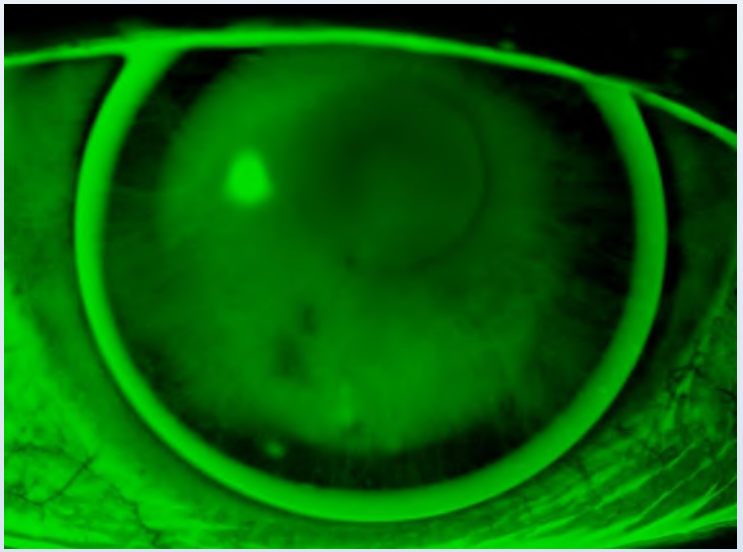


6.7(10.10)
Marked central clearance



RGP Fitting

- **Centration**
  - Better centration – better vision
  - Less flaring at night - especially with large pupils
  - If lens drops, try larger diameter or another trial set with similar BOZR
  - Lid attachment possible?



RGP Fitting

- **Centration**
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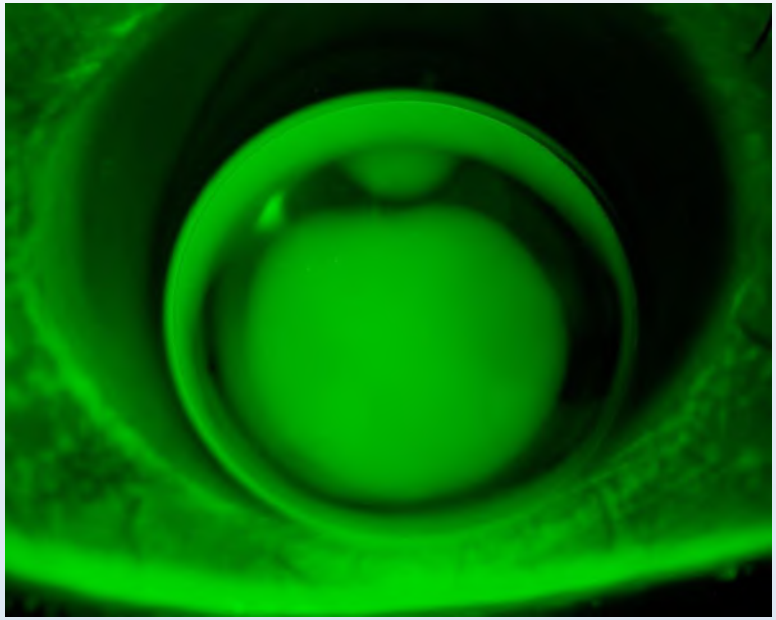
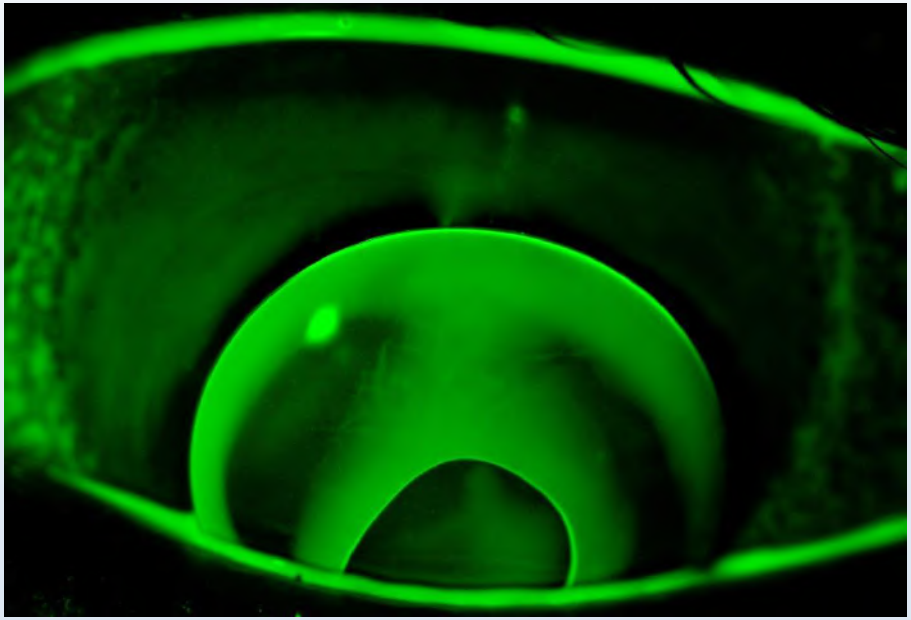
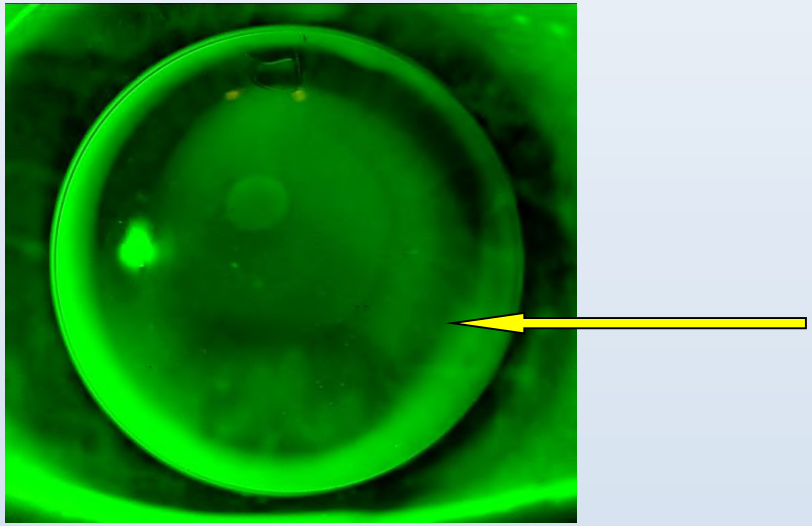




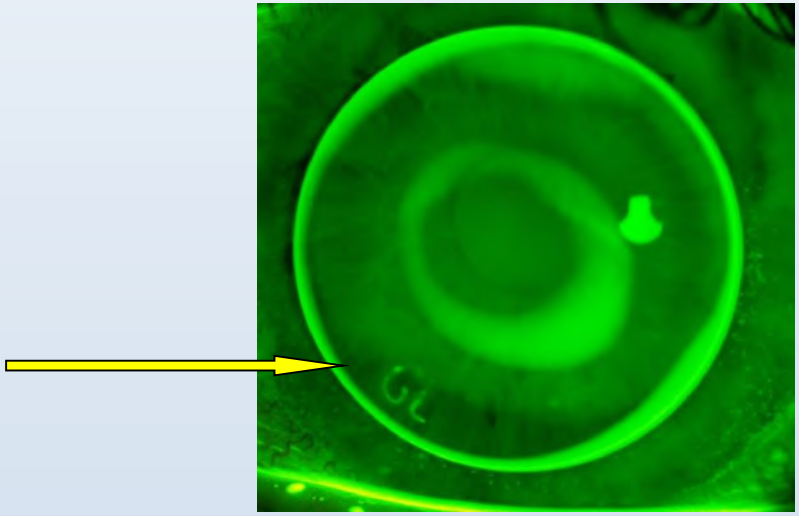
RGP Fitting

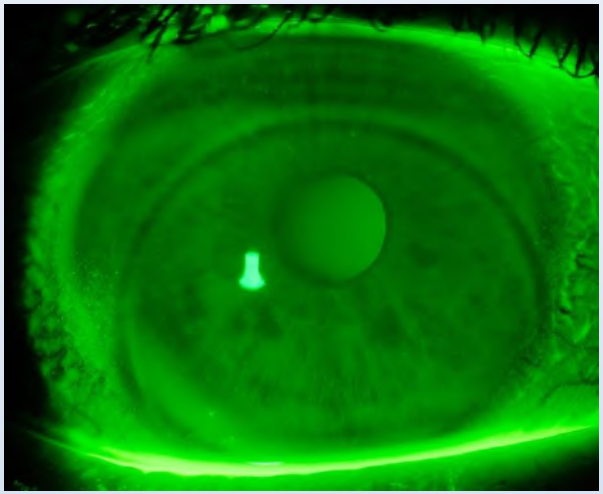
- **Edge**
- Adequate edge clearance allows sufficient tear exchange - better comfort, reliable and longer wearing times
- Optimal width - 0.5 mm
- Adequate edge clearance creates better centration and consequently better VA.
- An excellent edge width also allows good movement of the lens.



RGP Fitting

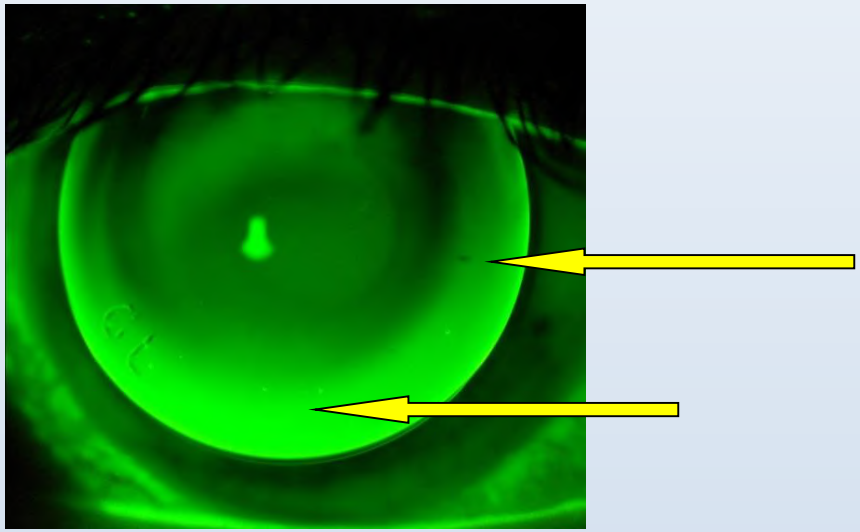
- **Edge**
  - **Tight edge**
  - May give good comfort because of limited movement and minimal lid interaction
  - Eventually it will cause increasing irritation and reducing and unreliable wearing times.





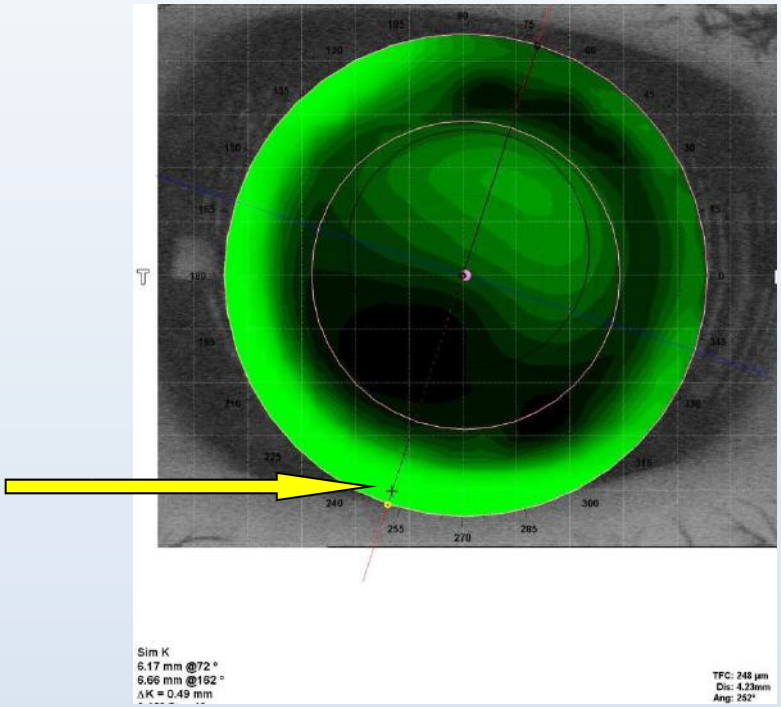
RGP Fitting

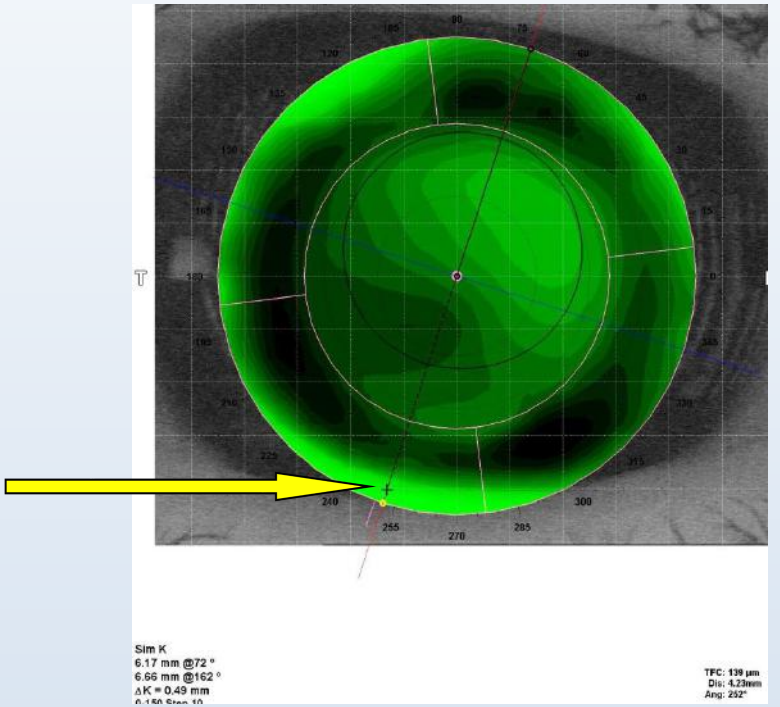
- **Edge**
  - **Loose edge**
  - May dislodge on excursions or unusual movements – such as reversing the car
  - Susceptible to foreign bodies
  - Order new lens with steeper peripheral radii



RGP Fitting

- **Inferior “Tuck”**
  - Reduce excessive inferior edge clearance with inferior steeper peripheral radii





- 6.60(9.0) inf edge 7.1, tear film 248µm

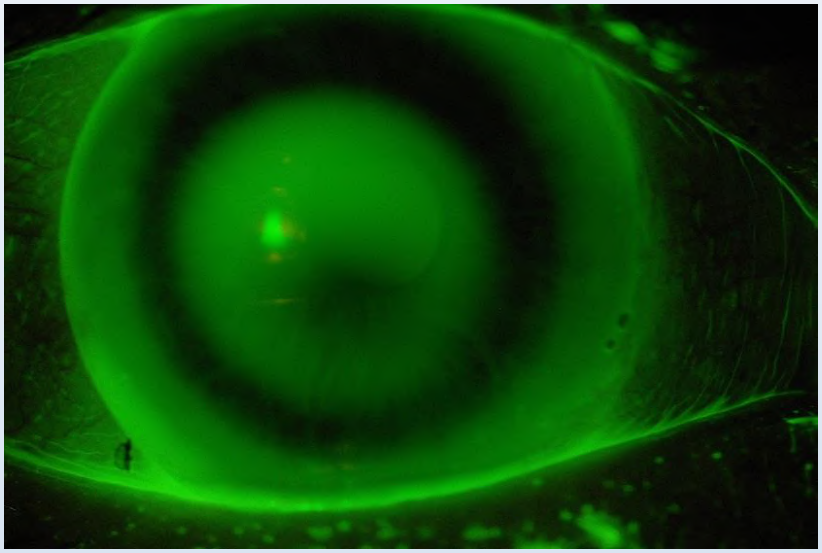
6.60(9.0) inf edge 5.50, tear film 139µm

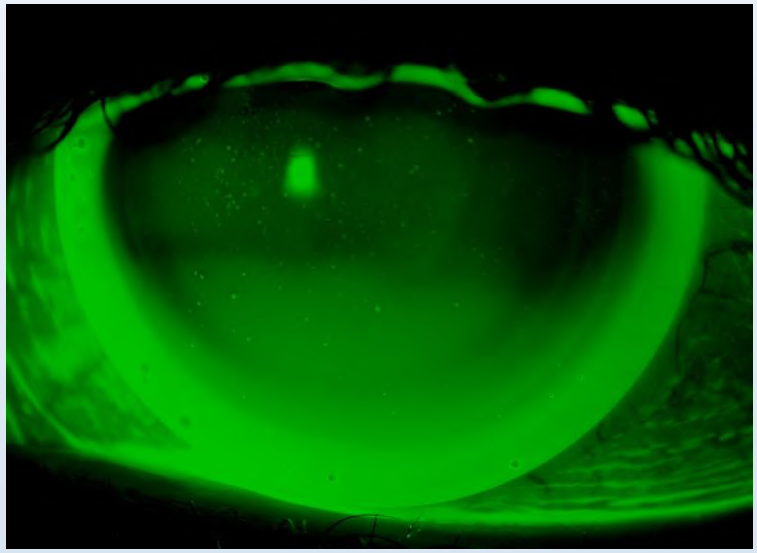
RGP Fitting

- **Overall Diameter**
  - Nipple cones and advanced keratoconus often will need smaller diameters to fit more accurately over the cone (8.0 – 9.0 mm)
  - Larger diameters more likely to achieve lid attachment (9.5 – 10.5mm)
  - Larger diameters have larger optic zones – less flaring at night, back optic zone diameter larger than the dilated pupil

RGP Fitting

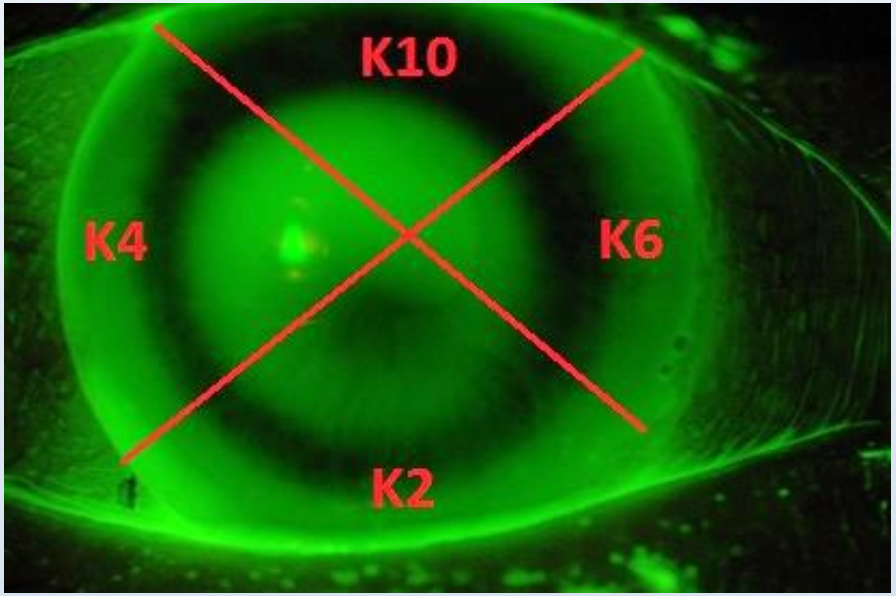
- **Larger RGP Designs – Corneo-Scleral**
  - (ACL) Limbal Lift – K 7 series (13.0 mm)
  - Spherical centre, aspheric periphery
  - Excellent centration, excellent comfort





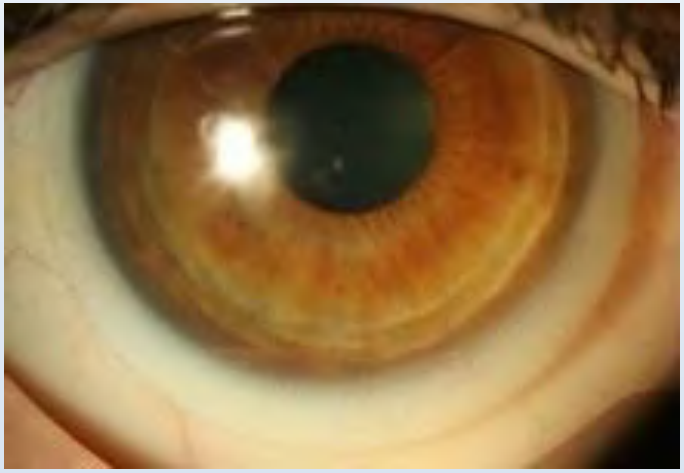
RGP Fitting

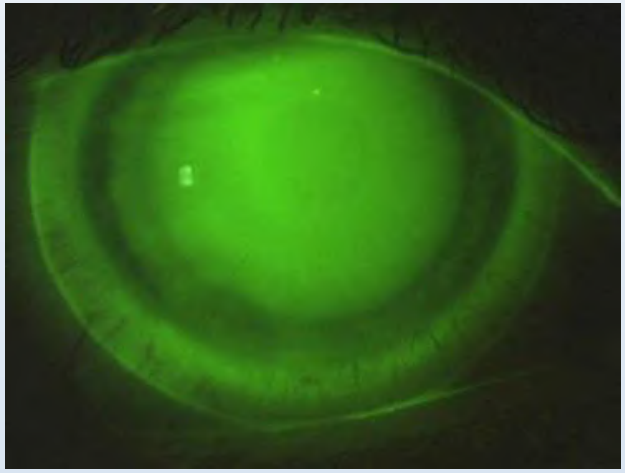
- **Larger RGP Designs – Corneo-Scleral**
  - (ACL) Limbal Lift – K 7 series
  - Can vary edge clearance by changing rate of peripheral flattening
  - K9 has increased edge clearance, K4 has decreased clearance
  - Quadrant Control – can vary edge clearance in different quadrants, better control of edge clearance – improved comfort and stability



RGP Fitting

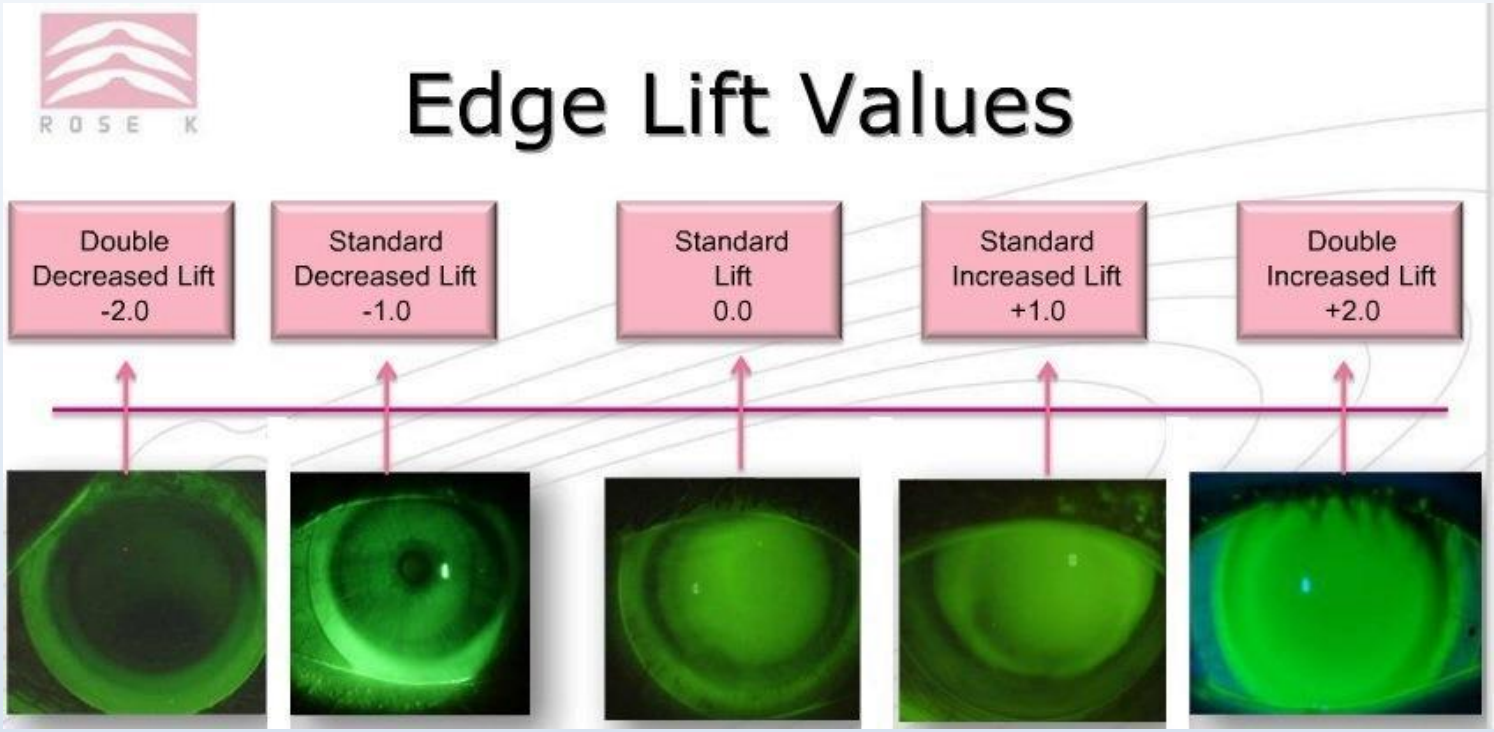
- **Larger RGP Designs – Corneo-Scleral**
  - Rose K2 XL
  - Base curve: 5.8 – 8.4mm
  - Diameter: 13.6 – 15.6mm (standard 14.6 mm)
  - Variable edge control
  - Rests primarily on the cornea just inside the limbus
  - Minimal movement





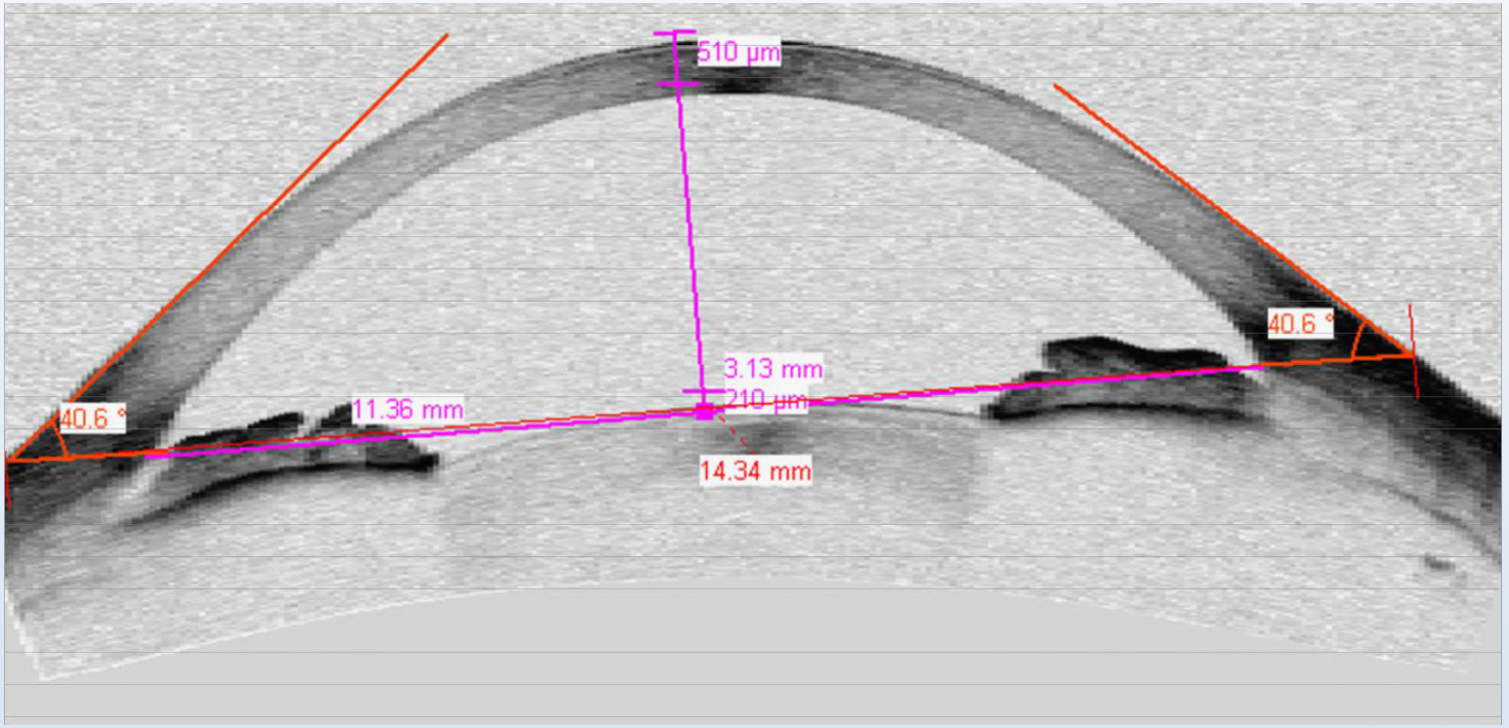
RGP Fitting

- **Larger RGP Designs – Corneo-Scleral**
  - Rose K2 XL
  - Can also be ordered in quadrant specific peripheral curves - customised edge control



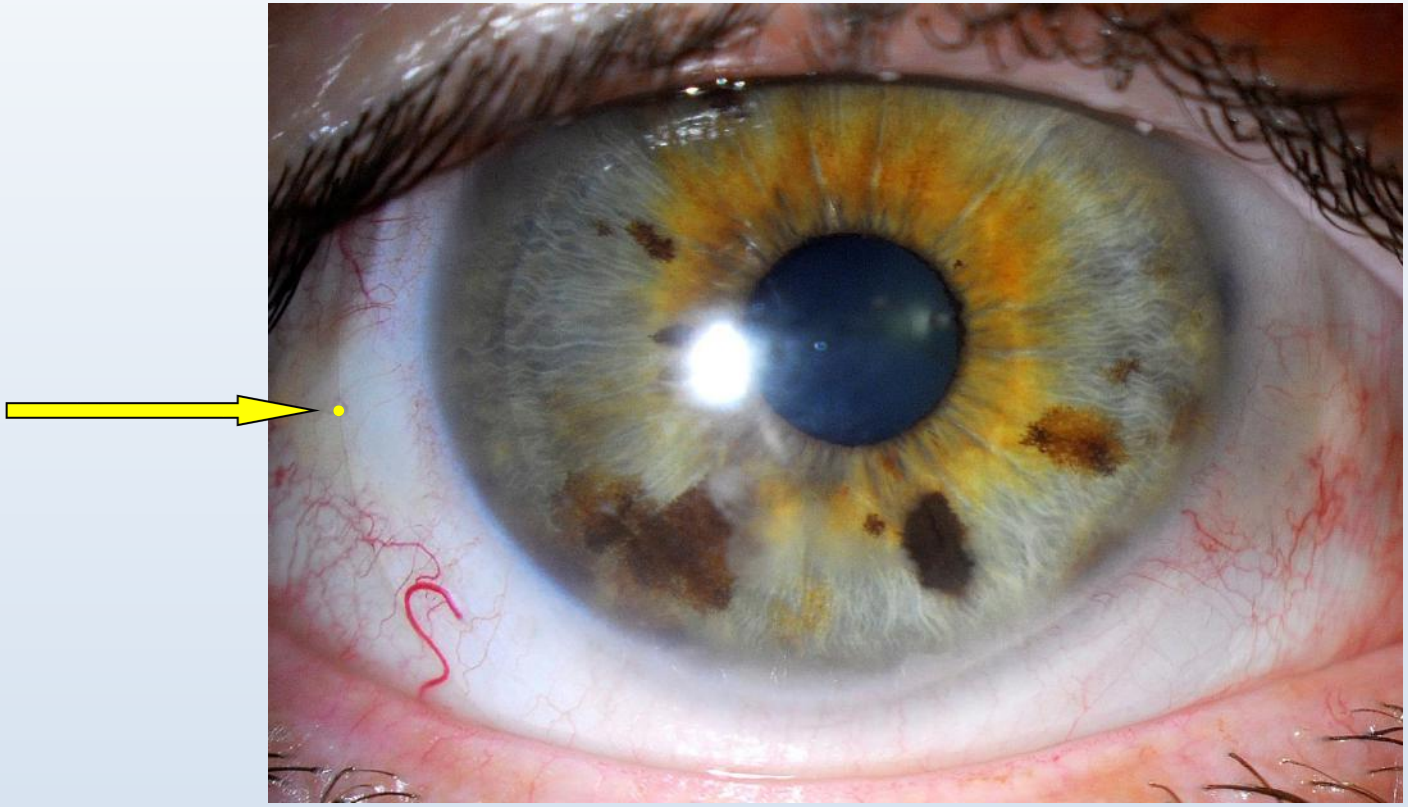
RGP Fitting

- **Larger RGP Designs – Miniscleral**



RGP Fitting

- **Larger RGP Designs – Miniscleral**
  - ICD or KATT (Capricornia) OD: 16.5 mm
  - 5zRS (Innovative Contact Lenses) OD: 16.5 – 20.00mm



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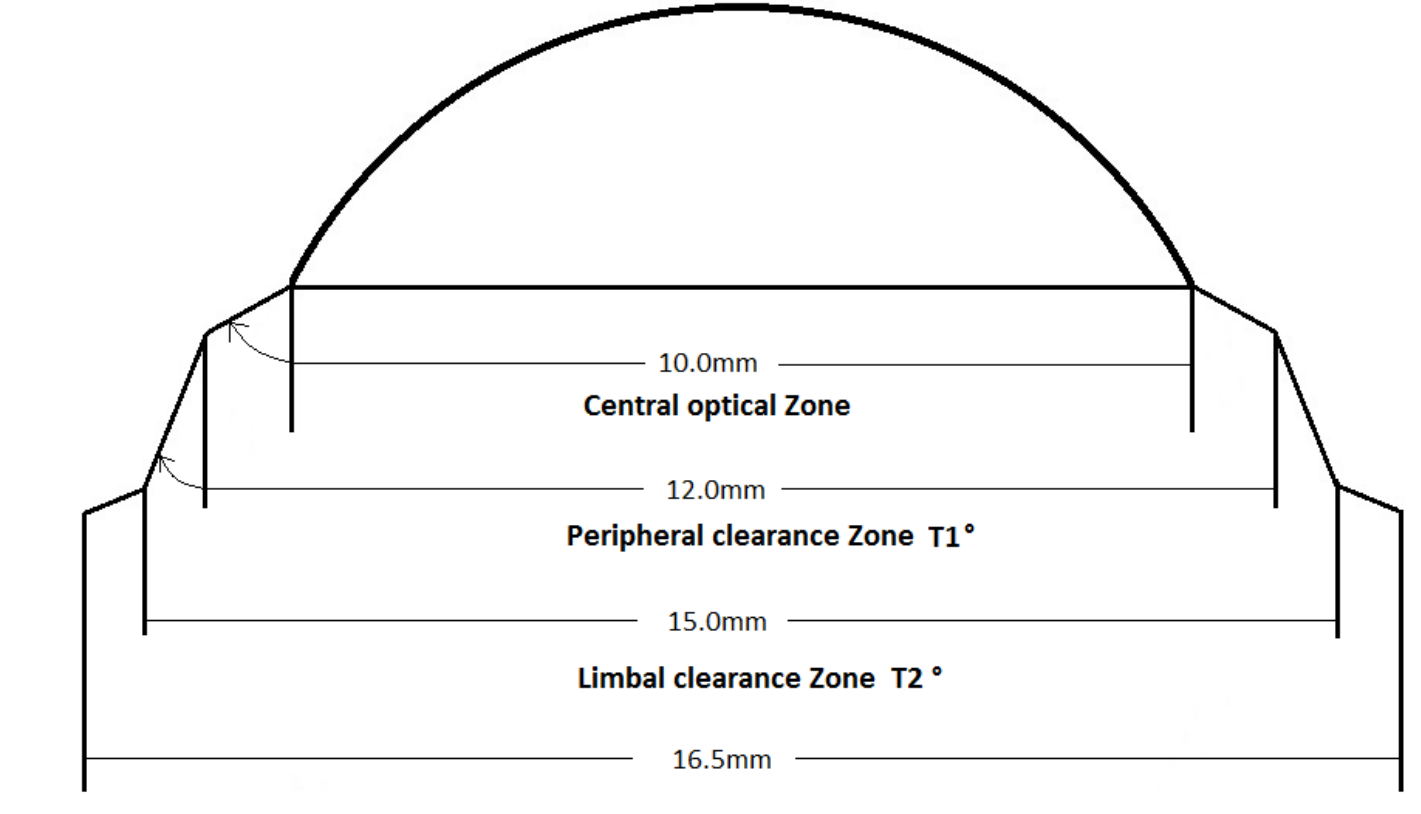

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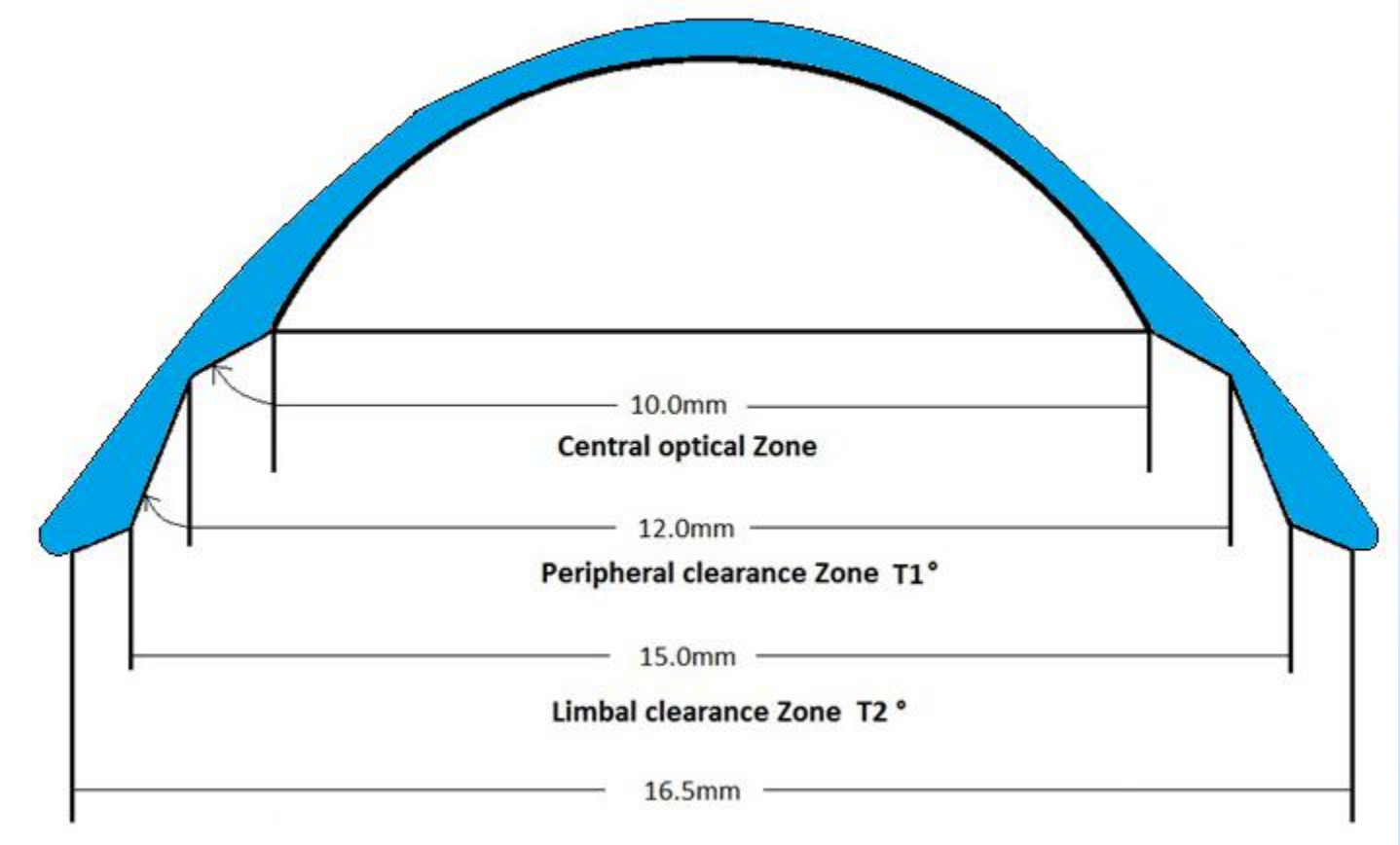
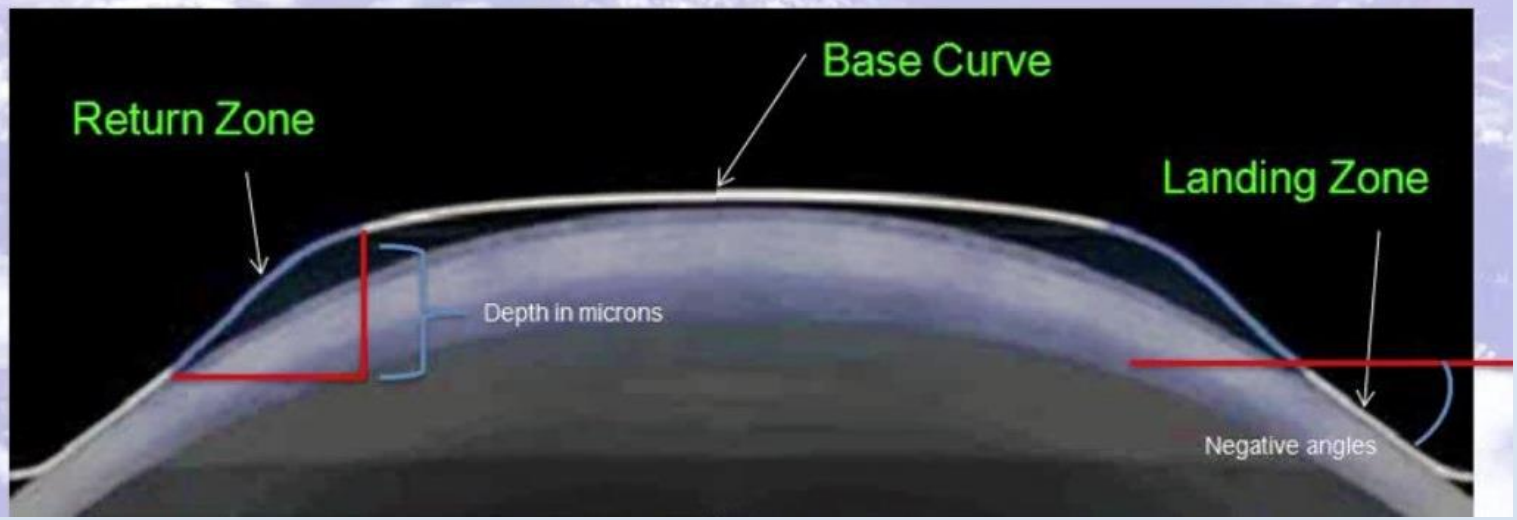


RGP Fitting

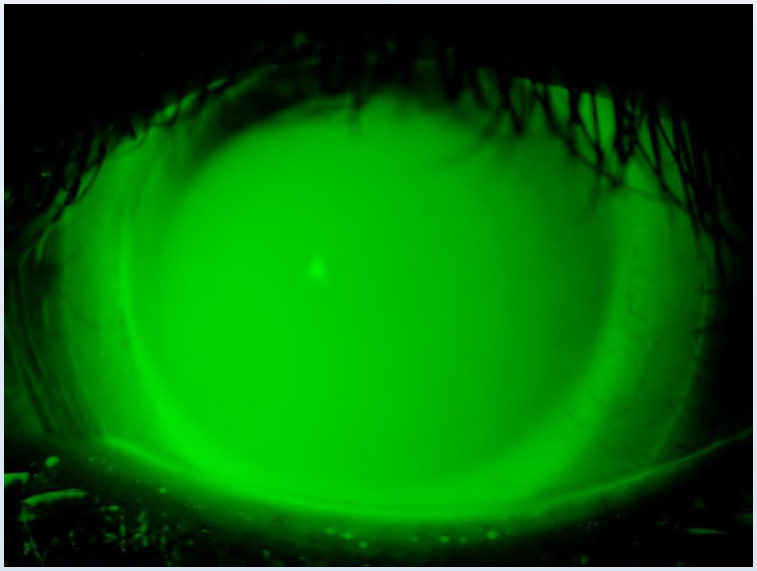
- **Larger RGP Designs – Miniscleral**
  - NormalEyes (Paragon) OD: 15.5 mm
  - Return Zone Depth – controls total sag of the lens
  - Landing Zone – controls limbal clearance and edge lift

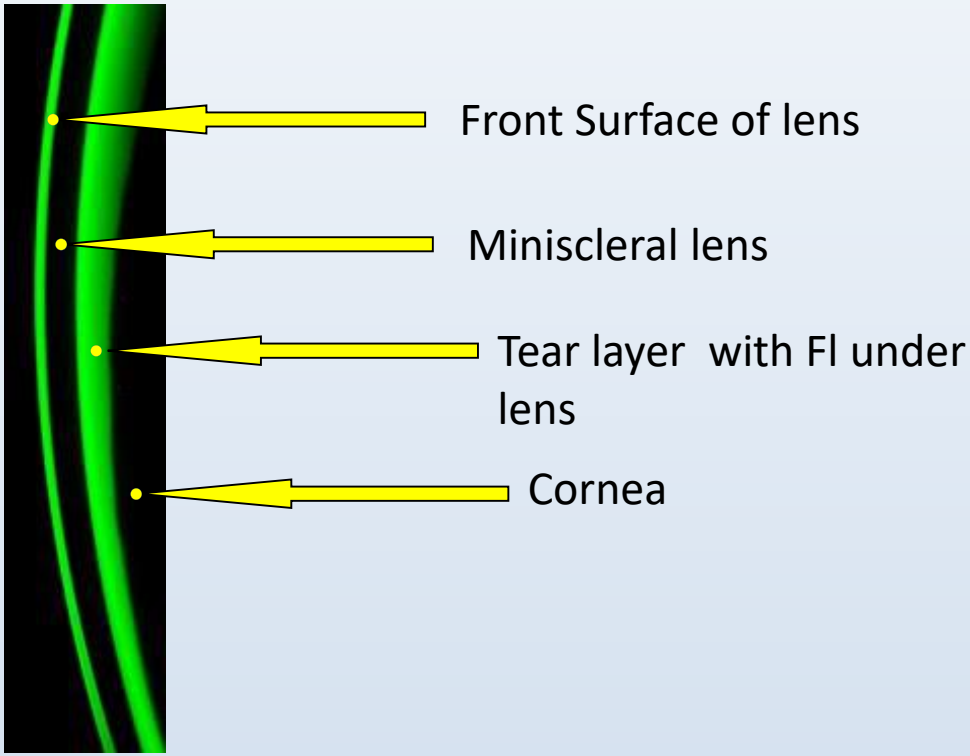
- Base Curve is measured in radius of curvature in mm (BCR)
- Return Zone is measured in microns = Return Zone Depth (RZD)
- Landing Zone is measured from horizontal in negative angles of degrees (LZA)



RGP Fitting

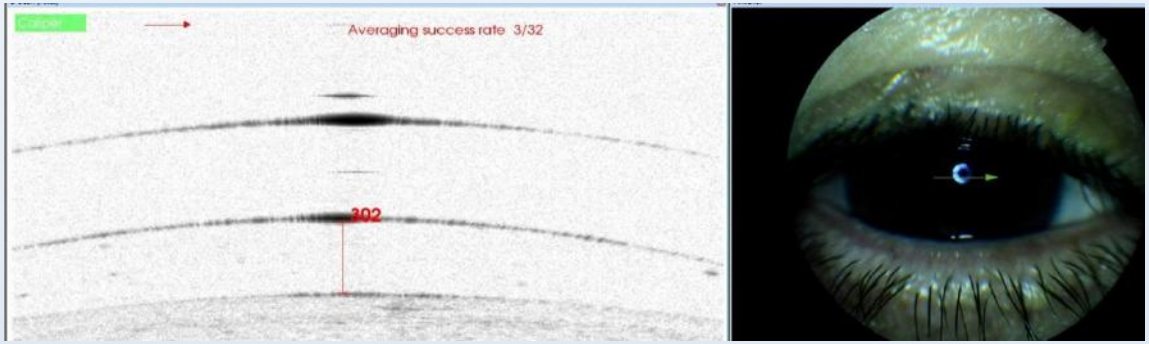
- **Larger RGP Designs – Miniscleral**
  - Designed to vault the cornea and land on the sclera
  - Central clearance is specified by sag in micron
  - Compare the thickness of TLT and thickness of the lens to assess clearance above the cornea (lens thickness is known – usually ~300 µm)





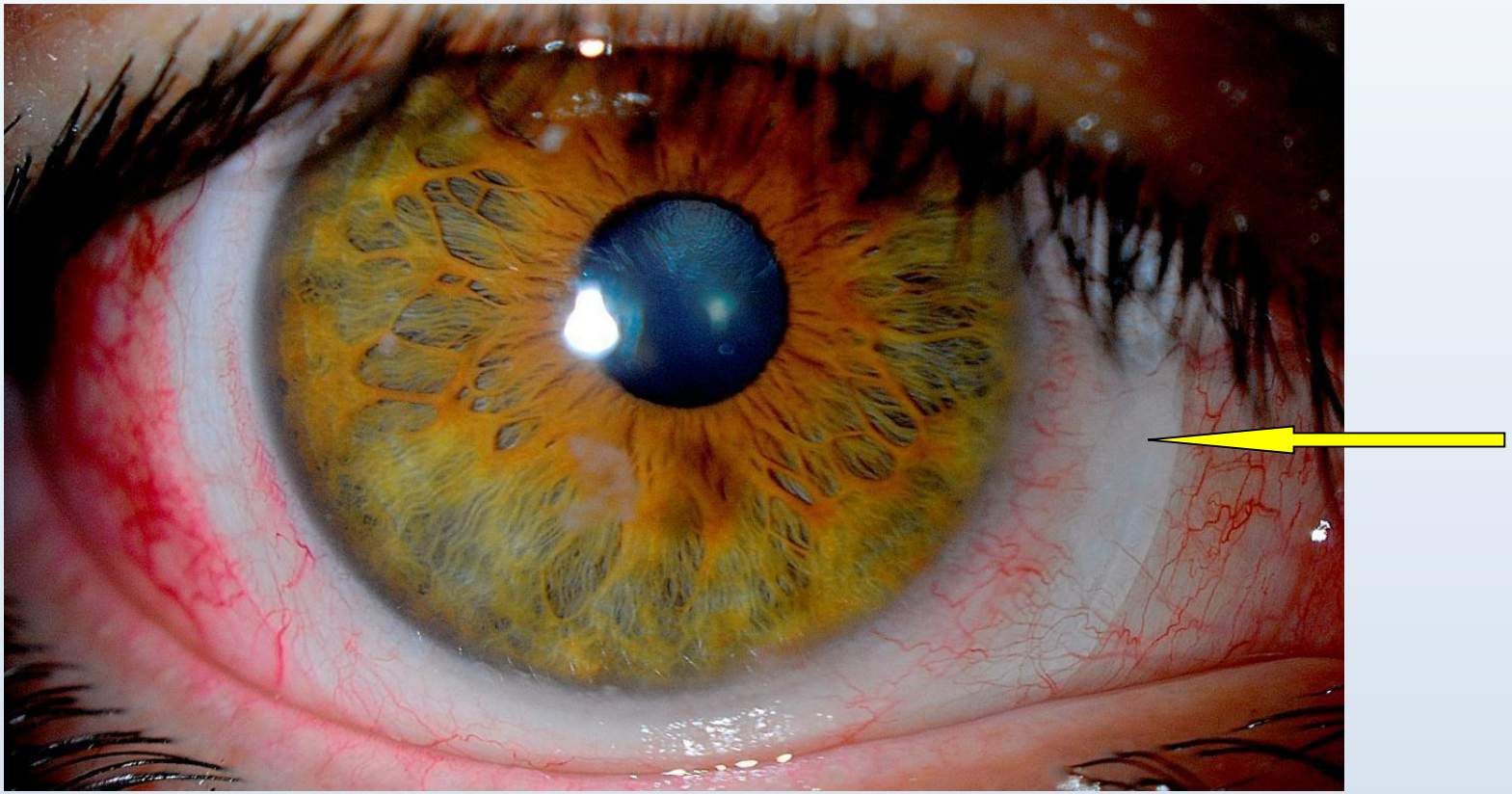
RGP Fitting

- **Larger RGP Designs – Miniscleral**
  - Anterior Optical Coherence Tomography (OCT) gives accurate measurements of central clearance , limbal clearance and edge profile
  - Important to ensure adequate limbal clearance
  - Important to avoid compression of conjunctival blood vessels at scleral landing point



RGP Fitting

- **Larger RGP Designs – Miniscleral**
  - Important to avoid compression of conjunctival blood vessels at scleral landing point



RGP Fitting

- **Larger RGP Designs – Miniscleral**
  - Miniscleral Lenses need to be inserted vertically full of solution to prevent trapping an air bubble underneath the lens
  - Inserting solutions – preserved saline, unpreserved saline, preservative-free tear lubricants or gels
  - Patients with small or deep-set eyes may find these lenses difficult to insert and remove

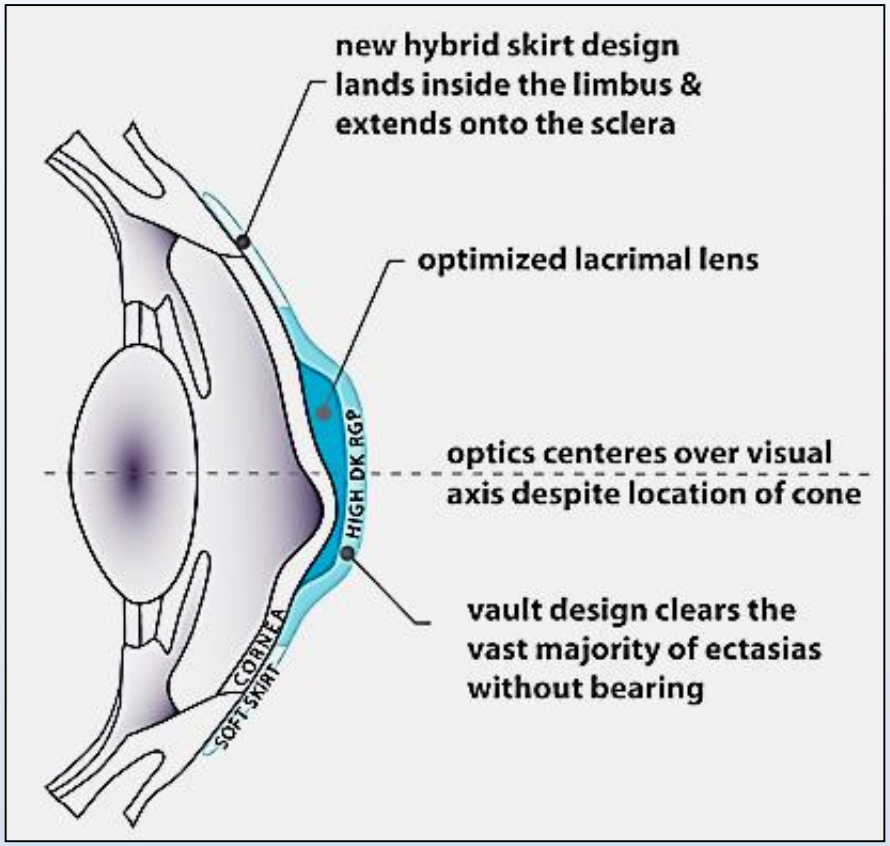
RGP Fitting

- **Larger RGP Designs – Miniscleral**
  - Optimal central clearance – 100 - 300 µm
    - Insufficient clearance may lead to bearing on the highest part of the cornea
    - Excessive clearance may cause excessive suction and tightness over the day, causing discomfort and difficulty removing the lens
  - Optimal limbal clearance – 30 -100 µm

RGP Fitting

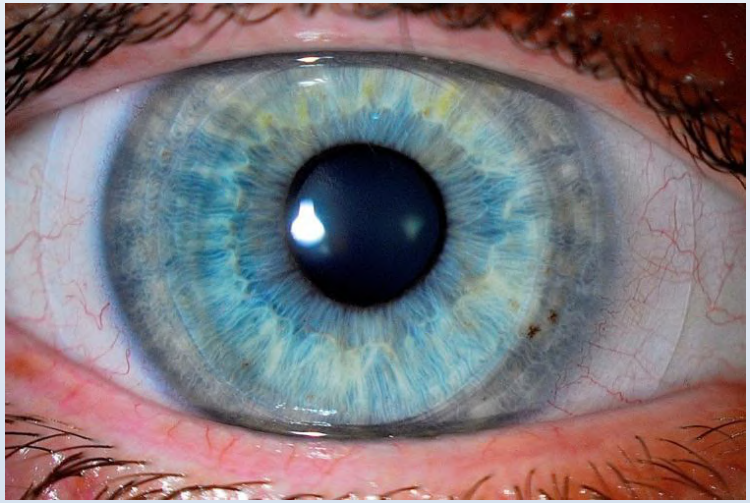
- **Hybrid Lenses – ClearKone (SynergEyes)**

  - Overall Diameter: 14.5 mm
  - RGP centre – 100 Dk (8.4 mm), Soft Skirt – 9 Dk (Hydrogel 27%)



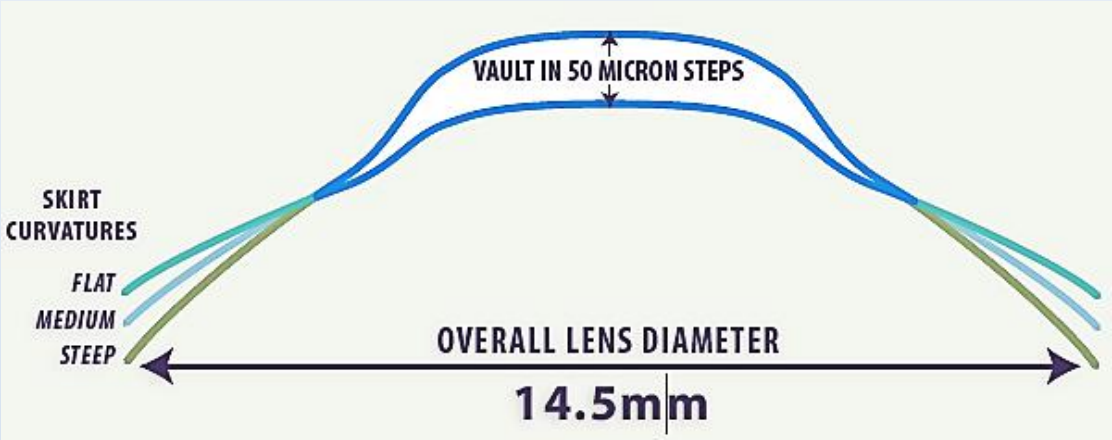
RGP Fitting

- **Hybrid Lenses – ClearKone (SynergEyes)**
  - Excellent comfort, soft skirt eliminates foreign bodies
  - Excellent stability – will not dislodge
  - Eliminates bearing on the cone
  - Excellent centration – decreases aberrations, optics are centred over the visual axis, regardless of the cone location
  - Excellent option for monocular Use
  - Excellent option for patients who are unable to tolerate an RGP lens



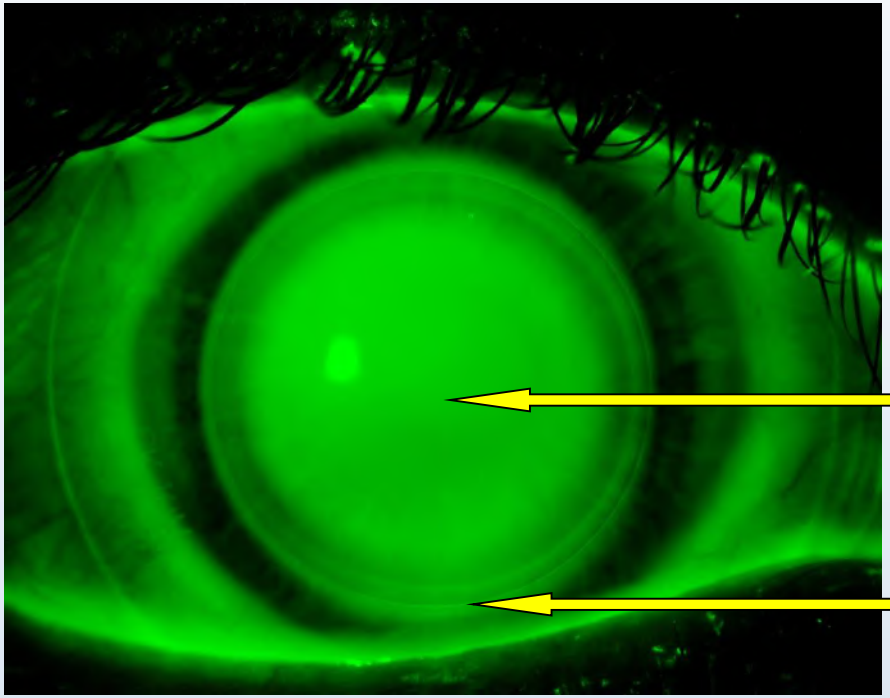
RGP Fitting

- **Hybrid Lenses – ClearKone (SynergEyes)**
  - Fitting based on sag height in microns (Vault), not BZOR
  - Need central corneal clearance
  - Vault range: 50 – 700 µm; Skirts – flat, medium, steep, steep2
  - Steeper skirt curvatures increase central clearance and clearance at soft/hard interface
  - +10.0 to -20.0
  - Reverse geometry design - flatter central curve – lower powers



RGP Fitting

- **Hybrid Lenses – ClearKone (SynergEyes)**
  - Recommended fluorescein pattern

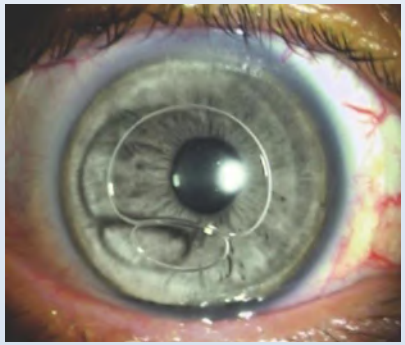


RGP Fitting

- **Hybrid Lenses – UltraHealth (SynergEyes)**
  - RGP centre – 130 Dk, Soft Skirt – **Silicon Hydrogel 84 Dk**
  - Reverse geometry design – same as ClearKone
  - Vault 50 – 750µm; Skirt – flat, medium, steep
  - Useful for early and moderate keratoconus
  - Insufficient sag to create central clearance in advanced keratoconus
  - +25.0 to -25.0

Large diameter lens handling

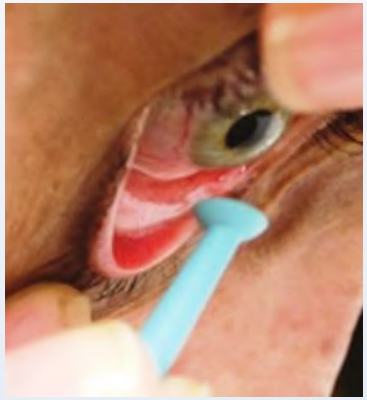
- **Insertion**
  - Miniscleral or hybrid lenses
  - Inserted face down, full of solution (usually Lens Plus)
  - Inserted using fingers or large DMV scleral inserter



  - If bubbles are present, must be removed and reinserted

Large diameter lens handling

- **Removal**
  - Need to break the seal by pushing under the lower lid and create a bubble
  - This breaks the suction



- Some patients struggle with insertion and removal

RGP Fitting

- **Adjustments for power change with change of Back Optic Zone Radius (Base Curve)**
  - Compensating for base curve changes

    SAM (steeper – add minus) **FAP** (flatter – add plus)
  - Always calculate correct power using the formula – approximations for power changes with base curve alterations become inaccurate with moderately steep or flat base curves.
  - Formula: 336/BOZR1 – 336/BZOR2 = power change

    e.g. BOZR: 8.1mm to 8.0mm = 41.48 – 42.00 = -0.52 D

    BOZR: 5.8mm to 5.7mm = 57.93 – 58.95 = -1.02 D

- **RGP materials**
  - Use High Dk materials to maximise oxygen permeability
  - Boston XO (100), Boston XO2 (141), Paragon HDS-100 (100)

RGP Fitting

- **Changing diameter**
  - To maintain the same sag when increasing the overall diameter, the base curve needs to be increased
  - Increase OD by 1.0 mm, increase BOZR by 0.1 mm

  - To maintain the same sag when decreasing the overall diameter, the base curve needs to be decreased
  - Decrease OD by 1.0 mm, decrease BOZR by 0.1 mm

Keratoconus – part 2

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Dip Oc Therapeutics Dip Humanities (Music)