1 **Management of Anterior Segment Diseases and Disorders with Specialty Contact Lenses**

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2 **Financial Disclosures**

- Valley Contax Inc.
  - Midwest Regional Education Consultant
-

3 **Introduction**

- BA in Biology, the University of Kansas, 2010
- Doctor of Optometry, The University of Houston College of Optometry, 2015
- Cornea and Contact Lens Residency, UMSL College of Optometry, 2015-2016
- Optometrist at Fairway Eye Center, Fairway, KS
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4 **Lecture Outline**

- Corneal Ectasias
  - Keratoconus
  - Pellucid Marginal Degeneration
  - Keratoglobus
  - Post Refractive Surgery
- Other Anterior Segment Irregularities
  - Scarring
  - Irregular Astigmatism
- Corneal Dystrophies
  - Epithelial Corneal Dystrophies
  - Stromal Corneal Dystrophies
-

5 **Corneal Ectasias**

- Keratoconus
- Pellucid Marginal Degeneration
- Keratoglobus
- Post Refractive Surgery Ectasia
  - LASIK/PRK
  - RK
-

6 **What is a Corneal Ectasia?**

- Ectasia is defined as dilation or distention of a tubular structure or hollow organ, either normal or pathophysiologic but usually the latter.
- Corneal ectasia is the outward protrusion of the cornea caused by focal thinning and/or structural changes to the corneal tissue.
- This thinning causes the cornea to take on a non-uniform shape, which makes conventional optical correction extremely difficult.
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8 **Keratoconus**

- Non-inflammatory disorder of the cornea
- Results in progressive steepening, irregular astigmatism, corneal thinning, and scarring
- Exact cause unknown
- Prevalence is estimated 1 in 2000, but some studies suggest it is much more prevalent
  - Prevalence varies widely depending on geographic region
- Often bilateral and asymmetric
- Typical onset late teens to early twenties

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10 **Keratoconus**

- Cornea usually thinner inferiorly but can happen anywhere on cornea
- Strong associations with atopic disease, connective tissue disorders, eye rubbing, and contact lens wear
- Tends to be progressive
- Confined to the cornea
- Can continue into middle age

11 **Keratoconus**

- Early detection and intervention is crucial for patient success
- Goal is to catch the patient early before significant irregularity and scarring is present
- Collagen cross linking should be implemented early to halt progression

12 **Keratoconus**

- Clinical Signs:
  - Corneal steepening, especially inferior
  - Degradation and loss of Bowman's Layer
  - Scarring at level of Bowman's Layer
  - Folds in deep stroma and endothelium (Vogt's striae)
  - Iron deposits within corneal epithelium (Fleischer's ring)

13 **Keratoconus**

- Clinical Signs:
  - Lower lid protrusion in downgaze (Munson's sign)
  - Oil droplet appearance of reflected light when shone through the patient's dilated pupil (Charleaux's sign)
  - Scissor reflex on retinoscopy
    - https://www.youtube.com/watch?v=dR8E-pOTxLU
  - Irregular mires during keratometry measurement
  - Irregular or pulsating mires during Goldmann applanation tonometry

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20 **Keratoconus**

- Refractive Management is Largely Case Dependent
- Spectacles
- Soft Contact Lenses
- Rigid Gas Permeable Lenses
  - Corneal Lenses
    - Spherical Lenses
      - Piggy back
    - Specialty Designs
  - Scleral Lenses
  -

21 **Keratoconus**

- Prevalence variable based on geographic location
  - A 1986 long term study in Minnesota showed prevalence of 54.5 cases per 100,000
    - 0.0545% prevalence
  - A 2007 study in Jerusalem showed higher prevalence of 2,340 cases per 100,000
    - 2.34% prevalence
  - A 2007 study in Denmark showed prevalence of 86 cases per 100,000
    - 0.086% prevalence
  - A 2009 study in rural India showed prevalence of approximately 2,300 cases per 100,000
    - ~2.3% prevalence
- Changing screening methods could affect number of cases detected annually for a given locale
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22 **Pellucid Marginal Degeneration**

- Non-inflammatory disorder of the cornea
- Similar to keratoconus, but localized to the inferior cornea
- Exact cause is unknown
- Pathophysiology also unknown, thought to be secondary to collagen abnormalities
- Corneal protrusion thought to be caused by intraocular pressure

23 **Pellucid Marginal Degeneration**

- Gets its name from meaning “transparent” or “clear”
- Ectatic portion of cornea tends to be clear despite structural change
- Diagnosis is made clinically, patients usually asymptomatic except for decline in acuity
- Area of greatest ectasia is superior to the area of greatest corneal thinning
  - “Kissing doves” or “Crab claws” topography pattern
- Similar pattern of onset and progression to keratoconus

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26 **Pellucid Marginal Degeneration**

- Clinical Signs:
  - Inferior corneal thinning and steepening
  - Clear cornea at area of ectasia
  - Reduced best corrected visual acuity with spectacles and contact lenses
  - Irregular mires on keratometry
  - *Kissing doves or crab claw topography pattern*

27 **Pellucid Marginal Degeneration**

- Refractive management similar to keratoconus
- Spectacle and conventional soft contact lens wear sometimes better tolerated in these patients
- Corneal and scleral RGP lenses are good options for these patients
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28 **Keratoglobus**

- Very rare!
- Non-inflammatory disorder involving the entire cornea
- Diffuse limbus to limbus corneal thinning
- Globular corneal protrusion
- Possibly an end stage form of keratoconus
- Extreme anterior segment irregularity

29 **Keratoglobus**

- Strong association with atopic disease and eye rubbing
- Two forms of the disease exist
  - Congenital
  - Acquired
- Exact etiology unknown
  - Strong association with Ehlers-Danlos Type IV, Marfan Syndrome, Blue sclera
  - May result from defects in collagen synthesis
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31 **Keratoglobus**

- Clinical Signs:
  - Globular corneal protrusion
  - High myopia common
  - Diffuse, limbus to limbus corneal thinning, most severe peripherally
  - Folds or breaks in Descemet's membrane
  - Diffuse steepening and irregular astigmatism on corneal topography

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32 **Keratoglobus**

- Spectacles usually not an option
- Refractive correction often extremely difficult even with use of rigid gas permeable lenses
- Large diameter scleral lens with high sagittal depth is most favorable option
  - Final power determination can be extremely difficult

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36 **Post-Refractive Surgery Ectasia**

- Structural weakening of cornea following corneal refractive surgery
- Exact cause unknown
- Can occur months to years after surgery
- Thorough preoperative screening is crucial to rule out subclinical corneal ectasia
  - Corneal pachymetry is essential
  - Scheimpflug imaging highly recommended
  - Posterior cornea is usually first to change if corneal ectasia is present
- Ultimately the surgeon is the gate keeper

37 **Post LASIK and PRK Ectasia**

- Gradual steepening of cornea
  - Can occur anywhere on cornea
- Increase in blurred uncorrected VA and irregular astigmatism
- Check topography on all refractive surgery patients
- Mid-periphery generally steeper than central cornea
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38 **Post LASIK and PRK Ectasia**

- Exact incidence rate unknown but condition is relatively rare
  - Roughly 1 in 2500 with older screening technologies
  - Roughly 1 in 4,000-5,000 with newer screening techniques
- Risk Factors
  - Abnormal preoperative topography
  - Residual stromal bed thickness 250 to 300 um
  - Younger patient age
  - Asymmetry of refractive error
  - High myopia
  -
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39 **Post Radial Keratotomy**

- Steeper mid-periphery and flatter central cornea
- Corneal shape can change throughout the day

- Diurnal IOP changes
- Hyperopic shift sometimes seen over time
- RGP lenses good option for these patients
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40 **Post Radial Keratotomy**

- Flat central cornea and relatively steep mid periphery makes small diameter lenses a challenge to fit and wear
- Large diameter corneal lenses are a good option
- Scleral lenses are also a great option
  - Vaulting the cornea eliminates corneal shape concerns
  - Tear lens can compensate for diurnal corneal shape changes
  - Lens handling and insertion can be challenging for older patients
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41 **Post Radial Keratotomy**

- "RK is ophthalmology's thalidomide"
- "A blade with a fool at both ends"
- Patients who have undergone RK are becoming older and have other health concerns, which may make contact lens wear more difficult and clear vision more difficult to obtain
  - Arthritis, mobility concerns, cataracts, etc.

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43 **Fitting Considerations for Corneal Ectasias**

- NO TWO CASES ARE THE SAME!!!
- Overall corneal shape must be considered
- These patients will likely have other anterior segment conditions that must be managed at the same time
  - "You can have as many diseases as you pleases"
- Often require more chair time, schedule accordingly!
- Stressful, life altering diagnosis for the patient
  - These patients, especially those are being initially diagnosed, will require thorough explanation and more hand holding

44 **Corneal Ectasia Case Examples**

45 **Keratoconus – CS, 45 yo WF**

- Long standing Hx of keratoconus OU
- Reports minimal success with SCLs and corneal RGP lenses
- Reports most recent lenses fog up "almost immediately"
- Referring OD tried multiple materials with no success
- Recent Hx of MVA with associated vertigo and diplopia due to head trauma
- Hx of multiple strabismus surgeries to correct childhood ET
- Also wears prism glasses to manage diplopia

46 **Keratoconus – CS, 45 yo WF**

- Biomicroscopy
  - L/L: WNL

- K: Inferior nasal steepening OU. Unstable tear film, reduced TBUT
- Conj: WNL
- Sclera: Normal
- Iris: Normal
- Lens: Normal
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- Fundus
  - Unremarkable
- No known family history of corneal ectasia
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48 **Keratoconus – CS, 45 yo WF**

- MRx
  - OD: -6.75 -5.50 x 050 (20/25)
  - OS: -4.50 -4.75 x 155 (20/25)
  - Reports asthenopia and diplopia when spectacles are worn
- Presenting CL Rx
  - OD: Dyna Intralimbal
    - 6.96 mm/9.0 mm/-7.50 DS/Paragon HDS 100 ($20/20^{-1}$)
  - OS: Dyna Intralimbal
    - 7.18 mm/9.0 mm/-5.50 DS/Paragon HDS 100 ($20/20^{-1}$)
  - Reports poor comfort and lenses fog up almost immediately when worn

49 **Keratoconus – CS, 45 yo WF**

- Trial CL Rx #1:
  - OD: Custom Stable Elite
    - 8.23 mm/4300 um sag/15.8 mm/+0.75 DS/Optimum Extra/Hydra PEG (20/20)
  - OS: Custom Stable Elite
    - 8.65 mm/4090 um sag/15.8 mm/+2.50 DS/Optimum Extra/Hydra PEG (20/20)
  - Approximately 300 um central clearance OU
  - Slight vertical movement upon blink with moderate edge lift OS
  - Greatly improved comfort compared to presenting lenses

50 **Keratoconus – CS, 45 yo WF**

- Follow Up #1:
  - Patient reports improved vision when lenses are worn
  - Lenses still have slight vertical movement upon blink
  - Instructed on lens I&R and lens care
  - Instructed to begin daily lens wear and RTC 1-2 weeks for follow up

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52 **Keratoconus – CS, 45 yo WF**

- Follow Up #2:

- Vertical movement still present on blink
- Reports improved comfort and vision compared to corneal RGPs
- Has to take out lenses and refill them mid day
- Landing zone of both lenses needed to be steepened to improve peripheral alignment
- New lenses ordered, instructed to continue daily lens wear until remakes arrive

53 **Keratoconus – CS, 45 yo WF**

- Follow Up #3:
  - Still had vertical lens movement upon blink and tear lens debris present after a few hours of wear
  - Steepened landing zone of both lenses to improve peripheral alignment
- Follow Up #4:
  - Patient reports these lenses no longer fog up during the day
  - Lenses no longer move vertically on blink
  - Dispensed final lenses to patient
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54 **Keratoconus – CS, 45 yo WF**

- Reported improved comfort with Hydra PEG and lenses fogged up much less frequently
- Still wears prism glasses over lenses to manage diplopia
- Sent back to referring OD for prism glasses prescribing and VT specific to her head injury.
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56 **Keratoconus – JS 51 yo WM**

- Long term scleral lens patient at UMSL Eye Center
- Long standing diagnosis of keratoconus (OS>OD)
- No longer able to wear OS scleral lens all day due to comfort issues
- Reports good vision with current scleral lenses, but his job requires 16-18 hours of lens wear
- Has had *LOTS* of remakes!
- Recommended EyePrint Pro custom molded scleral lens

57 **Keratoconus – JS 51 yo WM**

- MRx:
  - OD: -0.50 -1.25 x 060 (20/200)
  - OS: -3.00 -3.00 x 090 (20/200)
  - Unable to wear spectacles
- Presenting CL Rx:
  - OD: Unknown Corneal RGP
    - 7.50 mm/9.5 mm/-3.25 DS/Paragon HDS (20/25)
  - OS: Essilor Jupiter (#20)
    - 7.85 mm/18.2 mm/-3.50 DS/Boston XO (20/40)
  - Only able to wear OS lens for about 6 hours before having to remove lens
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63 **Keratoconus – JS 51 yo WM**

- Trial Lens #1
  - OS: Eyeprint Pro
    - 7.401 mm/18.8 mm/-6.87 DS (20/100)
    - OR: +2.50 DS (20/20^{-2})
    - Good fit with new lens and patient reported increased comfort
    - Instructed to begin daily lens wear and RTC in 3 days to check VA

64 **Keratoconus – JS 51 yo WM**

- Follow Up #1:
  - Still reports blurry DVA with current lens
  - Found +2.50 DS over refraction again and ordered new lens for him with power change
- Trial Lens #2
  - OS: Eyeprint Pro
    - 7.401 mm/18.8 mm/-4.37 DS (20/20^{-2})
    - OR: +0.25 DS (20/20^{-2})
    - Good fit with new lens
    - Reports constant monocular diplopia with new lens
    - Instructed to wear resume daily lens wear and RTC 3-4 weeks
-

65 **Keratoconus – JS 51 yo WM**

- Follow Up #2:
  - At next follow up patient reported diplopia no longer present
  - Comfort of new lens greatly improved compared to most recent Jupiter lens
  - Able to wear new lens 16-18 hours daily without issue
  - Lens showed ~300 um central clearance and ~100 um clearance over apex of ectasia
  - Was considering getting Eyeprint lens for OD

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69 **PMD – AB, 50 yo BM**

- Referred from doctor in the practice for scleral lens fitting
- Long standing history of PMD (OD>OS)
- Tried corneal RGP lenses with another provider in the past but unable to tolerate them
- Currently wears spectacles but has minimal improvement in VA when worn

70 **PMD – AB, 50 yo BM**

- Presenting Rx:
  - OD: -3.00 -4.50 x 096 (20/70)
  - OS: -2.50 -4.50 x 103 (20/50)
  - Reports asthenopia and diplopia when lenses are worn
- MRx:
  - OD: -2.50 -5.75 x 060 (20/60)
  - OS: -2.50 -6.00 x 093 ($20/40^{+1}$)
- Reports minimal subjective visual improvement with spectacle change

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72 **PMD – AB, 50 yo BM**

- Trial CL Rx #1:
  - OD: Custom Stable Elite
    - 7.50 mm/4870 um sag/15.8 mm/-4.00 DS/Optimum Extra (20/20)
  - OS: Custom Stable Elite
    - 7.50 mm/4870 um sag/15.8 mm/-4.25 DS/Optimum Extra (20/20)
- Will use OTC readers for near work
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73 **PMD – AB, 50 yo BM**

- Follow Up #1:
  - Reports improved distance vision with lenses
  - Says he can wear them all day without issue
  - Does not like to not use readers
  - Patient is an engineer and basketball coach and finds readers cumbersome
  - Discussed monovision and multifocal options and decided to try monovision

74 **PMD – AB, 50 yo BM**

- Trial CL Rx #2:
  - OD: Custom Stable Elite
    - 7.50 mm/4870 um sag/15.8 mm/-4.00 DS/Optimum Extra (20/20)
  - OS: Custom Stable Elite
    - 7.50 mm/4870 um sag/15.8 mm/-2.75 DS/Optimum Extra (20/100)
    - NVA 20/20 OU
- Initially fit for distance OU but decided he did not want to use readers
- OD distance monovision
- Reports good all day comfort and improved VA compared to previous lenses
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75 **PMD – AB, 50 yo BM**

- 1 Year Follow Up (8/14/19):
  - Reports he has not worn his lenses in 3-4 months due to OD discomfort
  - Reports pain, discomfort and "foggy vision" after a few hours of wear
  - Says vision is good overall with his lenses, but says his distance vision could be better
  - Recently diagnosed with cataracts, surgeon wants to have him refit before pursuing surgery

76 **PMD – AB, 50 yo BM**

- 1 Year Follow Up (8/14/19):
  - OD lens shows bearing between lens and inferior nasal cornea after insertion
  - OS lens fit consistent compared to last encounter
  - Both lenses have slight vertical movement on blink
  - Both lenses sit inferiorly on eye

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79 **PMD – AB, 50 yo BM**

- SCOR Over Current OD Lens:
  - +0.50 -1.00 x 035 (20/20)
  - Lens shows 5 L rotation on eye
- New CL Rx:
  - OD: Custom Stable Elite
    - 7.50/15.8/-3.50 -1.00 x 040/Optimum Extra
    - Steepened secondary curve to get lens off inferior cornea
    - Steepened peripheral curves to improve centration and limit vertical movement
  - OS: Custom Stable Elite
    - No power changes needed
    - Steepened peripheral curves to improve centration and reduce movement

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81 **PMD – DK, 32 yo WM**

- Presented as a new patient for comprehensive exam
- Long history of spectacle and contact lens wear with minimal issues
- All other medical and ocular history unremarkable
- "I just want to get new glasses and contacts"

82 **PMD – DK, 32 yo WM**

- Presenting Spectacles
  - OD: -3.00 -0.75 x 082 (20/20)
  - OS: -2.50 -2.00 x 115 (20/40)
- Keratometry:
  - OD: 43.50/44.25 @ 130
  - OS: 42.25/45.25 @ 030
- MRx:
  - OD: -3.25 -0.75 x 082 (20/20)
  - OS: -2.00 -2.00 x 122 (20/20)

83 **PMD – DK, 32 yo WM**

- Biomicroscopy
  - L/L: WNL
  - K: Slight inferior steepening OU
    - Very subtle

- Conj: WNL
- Sclera: Normal
- Iris: Normal
- Lens: Normal
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- Fundus
  - Unremarkable
- No known family history of corneal ectasia

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85 **PMD – DK, 32 yo WM**

- Contact Lens Trial:
  - OD: Air Optix for Astigmatism
    - 8.6/14.2/-3.50 -0.75 x 080 (20/20)
  - OS: Air Optix for Astigmatism
    - 8.6/14.2/-2.00 -1.75 x 140 (20/20)
  - Lenses showed good centration, movement and stable rotation
- Patient elects to split time between contact lenses and spectacles

86 **PMD – DK, 32 yo WM**

- Discussed initial diagnosis and specialty lens options with patient
- Currently not interested in rigid lens despite the chance of better vision
- Not all cases of corneal ectasia require use of specialty hard lenses!!!
- Discussed importance of close monitoring to track progression

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88 **Keratoglobus – RS, 37 yo WM**

- Presented for annual exam with complaints of comfort issues with his current scleral lenses
- Reports OD lens no longer comfortable
- Unable to wear OD lens for entire day
- Symptoms began two weeks prior and have not improved
- Long history of keratoconus, diagnosed with keratoglobus in 2012
- Hydrops OS in 2009

89 **Keratoglobus – RS, 37 yo WM**

- Biomicroscopy
  - L/L: WNL
  - K: Diffuse stromal thinning with globular corneal protrusion OU. Mid-peripheral stromal scarring from resolved hydrops OS.
  - Conj: WNL
  - Sclera: Normal
  - Iris: Normal
  - Lens: Normal
- Fundus
  - Unremarkable

- Distant family history of keratoconus
- Reported extensive eye rubbing throughout childhood
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91 **Keratoglobus – RS, 37 yo WM**

- Presenting CL Rx:
  - OD: TruForm Digiform Front Toric Scleral (20/25)
  - OS: TruForm Digiform Front Toric Scleral (20/25)
- Both lenses showed adequate centration and central clearance
- OD had area of bearing between lens and inferior nasal cornea
- OD lens rotated 90 degrees CCW from desired position
  - Rotation unstable when oriented in proper position
- Discussed options and opted to go with Eyeprint Pro custom molded scleral lens

92 **Keratoglobus – RS, 37 yo WM**

- Trial Lens Rx #1:
  - OD: Eyeprint Pro
    - 18.2 mm/6.366 mm/-15.12 -1.75 x 081 (20/25)
  - Adequate centration and central clearance, no longer had bearing on cornea
  - Patient reported good comfort and was able to wear lens for entire day
  - Still wearing TruForm Digiform lens in OS

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94 **Keratoglobus – RS, 37 yo WM**

- Presented to clinic a month later with complaints of extreme pain, photophobia and contact lens intolerance in OD
- OD lens showed large area of bearing between lens and inferior nasal cornea
- 3+ injection and 4+ ground glass edema OD
- Patient had developed a hydrops OD
- Did not appear to be due to lens wear
- Unable to control inflammation with topical hyperosmotics and aqueous suppressants
- Ended up needing a corneal transplant

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99 **Post LASIK Ectasia – JF, 36 yo CM**

- Referred from another doctor in the practice for scleral lens fitting
- Diagnosed with post LASIK ectasia OU in 2017 (OD>OS)
- Struggled with intralimbal lenses, never able to achieve comfortable all day wear
- His job requires long periods of lens wear and in search of another option than intralimbal lenses

100 **Post LASIK Ectasia – JF, 36 yo CM**

- Biomicroscopy
  - L/L: WNL
  - K: LASIK scars OU. Irregular astigmatism on topography (OD>OS)
  - Conj: WNL
  - Sclera: Normal
  - Iris: Normal
  - Lens: Normal
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-
- Fundus
  - Unremarkable

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102 **Post LASIK Ectasia – JF, 36 yo CM**

- Presenting Spectacles:
  - OD: -1.25 -1.25 x 100 (20/30)
  - OS: -1.00 -0.50 x 145 (20/60)
- Presenting CL Rx:
  - OD: Dyna Intralimbal
    - 6.62 mm/10.4 mm/-8.75 DS/Optimum Extra (20/40)
  - OS: Dyna Intralimbal
    - 7.58 mm/10.8 mm/plano DS/Optimum Extra (20/25)
- Patient unable to wear lenses for more than a few hours at a time due to poor comfort
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103 **Post LASIK Ectasia – JF, 36 yo CM**

- Presenting CL Rx:
  - OD: Dyna Intralimbal
    - 6.62 mm/10.4 mm/-8.75 DS/Optimum Extra (20/40)
  - OS: Dyna Intralimbal
    - 7.58 mm/10.8 mm/plano/Optimum Extra (20/25)
- Patient unable to wear lenses for more than a few hours at a time due to poor comfort

104 **Post LASIK Ectasia – JF, 36 yo CM**

- Trial Rx #1:
  - OD: Custom Stable Elite
    - 8.23 mm/15.8 mm/+2.50 -1.25 x 130/Optimum Extra (20/30)
    - 40 degrees left rotation
  - OS: Custom Stable Elite
    - 8.23 mm/15.8 mm/+3.00 -1.75 x 050/Optimum Extra (20/30)
    - 25 degrees right rotation
  - Extremely vague responses during subjective testing

105 **Post LASIK Ectasia – JF, 36 yo CM**

- Follow Up #1:

- OD: Custom Stable Elite
  - 8.23 mm/15.8 mm/+2.50 -1.25 x 130/Optimum Extra (20/40)
  - 5 degrees left rotation instead of 40 degrees left
- OS: Custom Stable Elite
  - 8.23 mm/15.8 mm/+3.00 -1.75 x 050/Optimum Extra (20/20-2)
  - 25 degrees right rotation as was seen at diagnostic fitting
  - VA improved slightly with +0.50 DS over OS
-

106 **Post LASIK Ectasia – JF, 36 yo CM**

- Trial Rx #2:
  - OD: Custom Stable Elite
    - 8.23 mm/15.8 mm/+2.50 -1.25 x 095/Optimum Extra
    - 5 degrees left rotation
  - OS: Custom Stable Elite
    - 8.23 mm/15.8 mm/+3.50 -1.75 x 050/Optimum Extra
    - 25 degrees right rotation

107 **Post LASIK Ectasia – JF, 36 yo CM**

- Follow Up #2:
  - OD: Custom Stable Elite
    - 8.23 mm/15.8 mm/+2.50 -1.25 x 095/Optimum Extra (20/20^{-1})
    - 5 degrees left rotation, stable
  - OS: Custom Stable Elite
    - 8.23 mm/15.8 mm/+3.50 -1.75 x 050/Optimum Extra (20/20^{-1})
    - 25 degrees right rotation, stable
- Instructed to continue daily lens wear and RTC in 2 weeks

108 **Post LASIK Ectasia – JF, 36 yo CM**

- Follow Up #3:
  - OD: Custom Stable Elite
    - 8.23 mm/15.8 mm/+2.50 -1.25 x 095/Optimum Extra (20/20^{-1})
    - OD lens now rotated 40 degrees right instead of 5 degrees right that was seen before
    - Tried OD Trial #1 again and no improvement in vision was seen even with proper rotation
  - No OS changes needed

109 **Post LASIK Ectasia – JF, 36 yo CM**

- OD Trial #3
  - OD: Custom Stable Elite
    - 8.23 mm/15.8 mm/+2.50 -1.25 x 095/Optimum Extra
- OD Refitting
  - OD: Custom Stable Elite
    - 8.23 mm/15.8 mm/+0.25/Optimum Extra (20/25)

110 **Post LASIK Ectasia – JF, 36 yo CM**

- Final CL Rx:
  - OD: Custom Stable Elite

- 8.23 mm/15.8 mm/+0.25/Optimum Extra (20/25)
- OS: Custom Stable Elite
  - 8.23 mm/15.8 mm/+3.50 -1.75 x 050/Optimum Extra ($20/20^{-1}$)
- Able to wear lenses all day with minimal issues.
- Still complains of symptoms of HOAs, especially in dimly lit environments
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112 **Post RK – DD, 71 yo CM**

- Presented for comprehensive exam and contact lens fitting
- Had RK in 1987 and now experiences asthenopia and visual fluctuations throughout the day
- Has multiple pairs of spectacles for different times of the day
- Unable to tolerate spectacles for long periods due to diplopia and eye strain
- Has tried corneal RGP and soft lenses with minimal success

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114 **Post RK – DD, 71 yo CM**

- Presenting Spectacle Rx:
  - OD: +3.00 -1.25 x 105 (20/30)
  - OS: -0.75 DS (20/25)
- MRx:
  - OD: +4.25 -0.50 x 095 (20/25)
  - OS: -0.75 DS (20/25)
- Keratometry:
  - OD: 36.50/37.25 @ 006
  - OS: 38.75/39.50 @ 176
- Biomicroscopy
  - 8 RK incisions OU
  - 1-2+ NS OU
  - All other structures unremarkable

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116 **Post RK – DD, 71 yo CM**

- Trial CL Rx #1:
  - OD: Custom Stable Elite
    - 8.23 mm/4330 um sag/15.8 mm/-1.75 -1.25 x 045/Optimum Extra (20/25)
    - 20 degrees left rotation
  - OS: Custom Stable Elite
    - 8.23 mm/4330 um sag/15.8 mm/-1.25 DS/Optimum Extra (20/20)
    - 20 degrees right rotation

117

118 **Post RK – DD, 71 yo CM**

- Adequate central clearance and centration OU
  - 150-200 um central clearance

- Adequate mid-peripheral clearance where cornea is steepest
- Reports good all day comfort and vision with current lenses
- Currently uses OTC readers for near

119

120 **Other Anterior Segment Irregularities**

- Scarring
- Irregular Astigmatism

121 **Corneal Scarring**

- Widely variable depending on the nature and severity of the injury
- Caused by either corneal injury or disease
- May cause permanent reduction in best corrected visual acuity
- RGP lenses are great options for these patients

122 **Corneal Scarring – Microbial Keratitis**

- Usually focal area of irregularity
- Generally there will be irregularity associated with scarring
  - This can limit visual potential even with the use of RGP lenses
- Scars can also make achieving a stable lens fit more difficult

123 **Corneal Scarring – Microbial Keratitis**

- Scarring at or near the visual axis may make achieving 20/20 vision impossible
  - Under promise and over deliver
- Deeper scars will be more likely to scar and be more dense

124 **Corneal Scarring – Herpes Simplex**

- Scarring will usually be irregular and correspond to area affected by dendritic lesions
- Wide variability in appearance of scarring
  - Stromal scarring and vascularization is common
- If vascularization present a high dK lens is needed

125 **Corneal Scarring – Herpes Simplex**

- Topography pattern highly irregular
- No characteristic topography pattern like other diseases
- RGP lenses often needed to manage irregularity caused by scarring

126 **Corneal Scarring - Trauma**

- Variable depending on severity and mechanism of trauma
- May not just involve cornea
  - Peripheral structures must be considered
- Extremely important to consider shape of entire anterior segment
- Custom molded scleral lens may be necessary for irregularity peripheral to cornea

127 **Corneal Scarring – Other**

- Corneal Hydrops
  - Spontaneous rupture in Descemet's membrane
  - Disrupts corneal deturgescence

- Pain, photophobia, stromal and epithelial edema, contact lens intolerance
- Self-limiting and will eventually resolve on its own
- Area of flattening will usually be present at area of swelling
- Scarring common following resolution

128

129 **Other Anterior Segment Irregularities**

- Glaucoma Filtering Surgery
  - Focal raised area immediately peripheral to limbus
  - Must take care to not compress bleb
  - Custom molded scleral lens or corneal RGP lens are best options if the patient requires a rigid lens

130 **Corneal Transplants**

- Irregular astigmatism widely variable in these patients
- Scleral and corneal RGP lenses good options
- Some patients do well with spectacles or soft contact lenses
- Need a high dK lens material
- Avoid graft-host junction

131 **Corneal Transplants**

- These patients require more frequent care to monitor graft integrity
- Endothelial cell count and confocal microscopy important for monitoring graft health
-

132 **Other Anterior Segment Irregularities Case Examples**

133 **Corneal Scarring – PR, 61 yo WF**

- Referred from another doctor in the practice for scleral lens fitting following severe central corneal ulcer OD
- In late November 2017 she presented to our clinic for evaluation of OD with complaints of pain and photophobia
- Diagnosed with central corneal ulcer OD and referred to corneal specialist for management
- Corneal specialist placed amniotic membrane on OD to aid healing
- Patient had allergic reaction to amniotic membrane making ulcer worse
-

134 **Corneal Scarring – PR, 61 yo WF**

- Six days after having allergic reaction to amniotic membrane placed she had OD LASIK flap amputated
- Corneal specialist Rx'd Moxifloxacin Q2hrs, Polytrim Q2hrs, and Prolensa BID
- After resolution patient had significant central and mid-peripheral scarring OD and reported large diurnal visual fluctuations
- Discussed RGP options and decided to try scleral lenses
-

135 **Corneal Scarring – PR, 61 yo WF**

- Medical Hx:

- Lupus, diagnosed 30 years ago
- Anxiety Disorder
- Sleep Disorder

- Ocular Hx:
  - Corneal scar s/t ulcer and LASIK flap amputation OD, 2017
  - LASIK OU, mid 2000's
  - Cataract Surgery OU, 2014
  - Long standing dry eye s/t Lupus
- Medications:
  - Topamax
  - Ambien
  - Clonazepam
  - Trazodone
  - Buspirone
  - Sertraline
  - Restasis
  - Lotemax

136 **Corneal Scarring – PR, 61 yo WF**

- Biomicroscopy
  - L/L: WNL
  - K: Dense central and paracentral scarring OD. LASIK scar OS.
  - Conj: WNL
  - Sclera: Normal
  - Iris: Normal
  - Lens: PCIOL OU, well centered in capsular bag
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139 **Corneal Scarring – PR, 61 yo WF**

- MRx before ulcer:
  - OD: +0.75 -2.75 x 050 (20/30)
  - OS: -1.25 -1.25 x 110 (20/30)
- MRx after ulcer healed (Dec 2017):
  - OD: +0.75 -4.50 x 030 (20/100)
  - OS: -0.25 -1.00 x 090 (20/25)
- MRx 9 months after ulcer (July 2019):
  - OD: +1.50 -2.00 x 020 (20/40)
  - OS: -0.75 -1.75 x 120 (20/40)

140 **Corneal Scarring – PR, 61 yo WF**

- Trial CL #1:
  - OD: Custom Stable Elite

- 8.23 mm/15.8 mm/+0.75 -1.00 x 155/Optimum Extra (20/25)
- OS: Custom Stable Elite
  - 8.23 mm/15.8 mm/+0.50 -0.75 x 060/Optimum Extra (20/25)
- Adequate central clearance and edge alignment
- Patient trialed monovision in office and did not like it.
-

141 **Corneal Scarring – PR, 61 yo WF**

- Follow Up #1:
  - Reported successful lens wear, but OS was not comfortable after a few hours
  - Stated she was only able to wear her lenses about 6 hours at a time due to dryness
  - OS lens showed slight vertical movement upon blink and VA improved with +0.25 DS over that eye
  - Discussed autologous serum options for management of dry eye
  - Rx 20% autologous serum gtts to be used QID OU
  - New OS lens was ordered to address vertical movement and with power change

142 **Corneal Scarring – PR, 61 yo WF**

- Follow Up #2:
  - Stated eyes felt much better since adding autologous serum to her dry eye regimen
  - Unable to wear lenses for more than a few hours at a time
  - Lenses now showed significant edge lift that was not there before
  - Decided to wait on scleral lenses until she felt like her eyes had time to adjust to autologous serum therapy

143 **Corneal Scarring – PR, 61 yo WF**

- Returned 2 months later for scleral lens refitting
- Both initial lenses showed significant edge lift and vertical movement
- Anterior segment greatly improved with autologous serum therapy
- Lenses no longer fitting well due to decreased inflammation
-

144 **Corneal Scarring – PR, 61 yo WF**

- Trial CL Rx #2:
  - OD: Custom Stable Elite
    - 8.23 mm/15.8 mm/+1.50-1.00 x 150/Optimum Extra (20/25)
  - OS: Custom Stable Elite
    - 8.23 mm/15.8 mm/+1.00 -0.75 x 050/Optimum Extra (20/25)
  - Patient elected to use PAL lenses with plano distance and +2.50 DS add over scleral lenses
  - Landing zone of this pair of lenses was much tighter than previous pair

145 **Corneal Scarring – PR, 61 yo WF**

- Follow Up #1:
  - Patient reported intermittent diplopia during course of lens wear
  - Both lenses showed unstable rotation compared to initial fitting
    - OD: 50 degrees left → 70 degrees left
    - OS: 45 degrees right → 30 degrees right

- At this point she decided to abandon scleral lens wear
- Currently getting by with spectacles only

146

147 **Herpes Simplex Scarring– RG, 66 yo WM**

- Referred for scleral lens fitting by another doctor in the practice
- Patient is long time hybrid lens wearer OS
- Referring doctor was concerned about OS lens bearing down on scarred area of cornea
- Patient reports no significant history of corneal pathology in either eye despite dense inferior scarring
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148 **Herpes Simplex Scarring– RG, 66 yo WM**

- Biomicroscopy
  - L/L: WNL
  - K: Dense area of scarring and vascularization extending from inferior limbus to mid peripheral cornea OS. OD unremarkable.
  - Conj: WNL
  - Sclera: Normal
  - Iris: Normal
  - Lens: Normal
-
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149

150 **Herpes Simplex Scarring– RG, 66 yo WM**

- MRx:
  - OD: -3.50 -0.50 x 026 (20/20)
  - OS: -2.25 -3.25 x 170 (20/20)
- Presenting CL Rx:
  - OD: Biofinity Multifocal 8.6 mm/14 mm/-4.00 DS/+2.00D Add (20/20)
  - OS: Synergeyes Duette 7.3 mm/14.5 mm/ -4.00 DS (20/20)
  - Areas of bearing seen between RGP lens and area of dense scarring on inferior mid-peripheral cornea with associated staining

151 **Herpes Simplex Scarring– RG, 66 yo WM**

- Trial CL Rx #1:
  - OD: Custom Stable Elite
    - 7.85 mm/15.8 mm/-1.00 DS/Optimum Extra (20/30)
  - OS: Custom Stable Elite
    - 7.85 mm/15.8 mm/plano DS/Optimum Extra (20/25)
  - Both lenses showed 200 um central clearance and slight vertical movement on blink
  - VA decreased due to lens movement
  - Peripheral curves of both lenses were tightened

152 **Herpes Simplex Scarring– RG, 66 yo WM**

- Follow Up #1:
  - OD lens showed good central and peripheral alignment
  - OS had excessive central clearance and vertical movement upon blink after settling despite minimal fitting changes being made after diagnostic fitting
  - OS lens was remade with additional peripheral changes to improve lens alignment, no power changes needed
  - OD lens dispensed to patient and he was instructed to continue wearing hybrid while we waited for new OD lens to come in

153 **Herpes Simplex Scarring– RG, 66 yo WM**

- Follow Up #2:
  - Lost track of the patient for about 6 weeks
  - New OS lens showed slight vertical movement that stabilized after settling
  - Stated he was not completely filling lens bowl with saline prior to insertion
  - Paitent re-trained in office and reported better comfort
- Follow Up #3:
  - No longer having issues inserting lenses, and comfort greatly improved
  - Able to wear lenses all day without comfort or vision issues
  -

154

155 **Trauma – DG, 25 yo WM**

- Presented to UMSL Eye Center for annual exam and scleral lens fitting
- Reports comfort issues with his current OS scleral lens
- Patient suffered OS penetrating injury with broken drill bit in 2011
  - Partial Iridectomy
  - Retinal Detachment
  - Lensectomy with IOL implantation
  - Penetrating Keratoplasty
  - Taking Combigan BID OS for glaucoma s/t his injury and multiple surgeries
- Also wears custom painted soft lens for cosmesis and photophobia

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159 **Trauma – DG, 25 yo WM**

- MRx:
  - OD: plano DS (20/20)
  - OS: -5.25 -6.00 x 002 (20/30)
- Presenting CL Rx:
  - OD: None (20/20)
  - OS: Essilor Jupiter
    - 8.65 mm/18.6 mm/-1.63 DS/Boston XO (20/50)

- ~500 um central clearance
- Mild bearing at superior graft-host junction
- Temporal edge lift

- Recommended Eyeprint to achieve better lens fit and comfort
  -

160 **Trauma – DG, 25 yo WM**

- SCOR over Habitual Lens
  - OS: +0.25 -1.00 x 180 ($20/30^{+2}$)
- Trial CL Rx #1:
  - OS: Eyeprint Pro
    - 7.991 mm/17.5 mm/-5.62 -1.00 x 180 ($20/25^{-1}$)
      - ~260 um central clearance
      - ~80 um superior clearance at graft-host junction
      - Adequate graft-host junction clearance in all other quadrants
      - Good peripheral alignment in all quadrants
- Dispensed lens to patient, instructed to RTC 3 weeks

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165 **Trauma – DG, 25 yo WM**

- Follow Up #1:
  - Reported improved vision and comfort with new OS lens
  - Able to wear lens up to 15 hours per day without issue
  - $20/20^{-1}$ VA
  - ~50 um clearance over superior graft-host junction after 4 hours of settling
  - Instructed to RTC 3 months for further follow up
  -

166

167 **Corneal Transplant – NM, 37 yo BF**

- Referred by doctor in the practice for scleral lens fitting
- Diagnosed with bilateral keratoconus in her teens
- Has had bilateral penetrating keratoplasties due to corneal scarring
- Currently being monitored by corneal specialist in the area, states he would like to redo OS sometime soon
- Wants a contact lens option that provides better comfort and vision than her current soft lenses
- Regularly travels to Kenya for her job and needs something that can be worn comfortably all day

168 **Corneal Transplant – NM, 37 yo BF**

- Biomicroscopy
  - L/L: WNL

- K: Clear graft OD. Corneal graft with clear center and moderate opacity at graft-host junction OS.
- Conj: WNL
- Sclera: Normal
- Iris: Normal
- Lens: Normal
-

169

170 **Corneal Transplant – NM, 37 yo BF**

- MRx:
  - OD: -5.50 -0.75 x 090 (20/20)
  - OS: -5.00 -2.50 x 090 (20/50)
- Presenting CL Rx:
  - OD: Acuvue Oasys for Astigmatism
    - 8.6mm/14.5 mm/-5.00 -0.75 x 090(20/30)
  - OS: Acuvue Oasys for Astigmatism
    - 8.6 mm/14.5 mm/-5.00 -2.25 x 090 (20/40)
  - Reports significant visual fluctuations throughout the day

171 **Corneal Transplant – NM, 37 yo BF**

- Trial CL #1:
  - OD: Custom Stable Elite
    - 7.85 mm/15.8 mm/-5.00 DS/Optimum Extra (20/20)
  - OS: Custom Stable Elite
    - 7.50 mm/15.8 mm/-7.25 DS/Optimum Extra (20/20)
  - ~350 um central clearance OU after about 20 minutes
  - Adequate clearance of graft-host junction 360 OU
  -

172 **Corneal Transplant – NM, 37 yo BF**

- Follow Up #1:
  - Lenses showed excessive clearance after settling
    - OD: ~500 um
    - OS: ~400 um
  - Patient reported good comfort and vision with new lenses
  - Lenses remade with flatter secondary curves to maintain clearance of graft-host junction and reduce central clearance over graft
- Follow Up #2:
  - Central clearance greatly improved compared to initial lenses
  - Able to wear lenses for full day without comfort or vision issues

173

174 **Corneal Transplant – JB, 45 yo WM**

- Presented for annual comprehensive exam and contact lens fitting
- Diagnosed with keratoconus in his late teens

- Corneal transplant OD in 2001 s/t scarring
- Currently fit in corneal RGP lenses OU, says "they're fine"
  - Also reports OD lens frequently dislodges and vision fluctuates constantly
- Skeptical about other forms of correction

175 **Corneal Transplant – JB, 45 yo WM**

- Biomicroscopy
  - L/L: WNL
  - K: Clear graft OD. Inferior steepening with corneal endothelial folds OS
  - Conj: WNL
  - Sclera: Normal
  - Iris: Normal
  - Lens: Normal
-

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177 **Corneal Transplant – JB, 45 yo WM**

- MRx:
  - OD: -17.00 -7.50 x 060 (20/50)
  - OS: -12.25 -6.00 x 090 (20/30)
- Presenting CL Rx:
  - OD: Dyna Intralimbal
    - 6.75 mm/10.8 mm/-13.87 DS (20/40)
  - OS: Dyna Intralimbal
    - 8.08 mm/9.4 mm/-10.50 DS (20/30)
  - OD lens has several areas of central bearing, bubbles under lens, superior and temporal edge lift, and consistent temporal decentration

178 **Corneal Transplant – JB, 45 yo WM**

- Trial CL Rx #1:
  - OD: Custom Stable Elite
    - 7.18 mm/15.8 mm/-17.00 DS/Optimum Extra(20/25)
  - OS: Custom Stable Elite
    - 7.85 mm/15.8 mm/-11.50 DS/Optimum Extra(20/20)
  - Both lenses had ~300 um central clearance after settling
  - OD secondary curve steepened to avoid graft-host junction

179 **Corneal Transplant – JB, 45 yo WM**

- Follow Up #1:
  - Patient reported slight distance blur with current lenses
  - Over refraction improved vision
    - OD: -2.00 DS (20/20)
    - OS: -1.oo DS (20/20)
- Trial CL Rx #2:
  - OD: Custom Stable Elite
    - 7.18 mm/15.8 mm/-19.00 DS/Optimum Extra(20/20)

- OS: Custom Stable Elite
  - 7.85 mm/15.8 mm/-12.50 DS/Optimum Extra(20/20)
-

180 **Corneal Transplant – JB, 45 yo WM**

- Follow Up #2:
  - Reports improved vision, especially in OD
  - No longer experiences lenses dislodging from eyes
  - Dispensed lenses to patient and instructed to resume daily lens wear

181 **Questions?**

182 **Anterior Segment Dystrophies**

- Epithelial Dystrophies
  - Anterior Basement Membrane Dystrophy
  - Recurrent Corneal Erosion
- Stromal Dystrophies
  - Lattice Dystrophy
  - Granular Dystrophy
  - Macular Dystrophy
  -

183 **Dystrophy vs. Degeneration**

- Dystrophy
  - Usually inherited, autosomal dominant
  - Relatively early onset
  - Usually affect single layer of the cornea
  - Have distinctive patterns and severity based on the stage of the condition
  -
  -
- Degeneration
  - Usually the result of some disease process
    - RA, Syphilis, Crohn's, etc.
  - Usually later onset
  - Often Unilateral, asymmetric and peripheral
  - Result in thinning, deposition, or vascularization of corneal tissue
  -

184

185 **Epithelial Dystrophies**

186 **Anterior Basement Membrane Dystrophy**

- Most common anterior corneal dystrophy
- Caused by over-production of basement membrane
- Pain on awakening
- Blurred vision
- Monocular diplopia

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187 **Anterior Basement Membrane Dystrophy**

- Changes apparent in anterior cornea
- Best observed in retro illumination with dilated pupil
- Map-Dot-Fingerprint Dystrophy
  - Intraepithelial microcysts (dots)
  - Map-like greyish patches
  - Fingerprint parallel lines
- Cogan's Microcystic Dystrophy
  - Only epithelial microcysts present
-

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190 **Anterior Basement Membrane Dystrophy**

- Usually respond well to conventional therapy
  - Topical lubrication
  - Bandage contact lens
  - Epithelial debridement
  - Topical hyperosmotics
- Some cases may require PTK or anterior stromal puncture

191 **Recurrent Corneal Erosion**

- Caused by poor adhesion between epithelium and underlying basement membrane
- Usually result from trauma
- Can recur multiple times during healing process
- Fingernail trauma is most common mechanism of trauma

192 **Recurrent Corneal Erosion**

- Desmosome formation can take weeks following injury
- Weak desmosome attachment makes RCE more likely during normal course of healing
- RCEs most common upon awakening
- Frequent lubrication extremely important to minimize chance of recurrence

193 **Stromal Dystrophies**

194 **Lattice Dystrophy**

- Autosomal dominant
- Rod-like, glassy opacities in anterior stroma
- Presents first or second decade of life
- Most common is Type 1
  - Amyloid deposits

195 **Lattice Dystrophy**

- Diagnosis made based on clinical appearance

- RCEs and anterior stromal haze may develop over time
- Treatment usually bandage contact lenses and lubrication for RCEs

196 **Lattice Dystrophy**

- Penetrating keratoplasty is treatment of choice when acuity is significantly reduced
- Recurrence is common, and may be treated with PTK
- PTK often used before penetrating keratoplasty is considered

197 **Granular Dystrophy**

- Autosomal dominant
- Discrete opacities in stroma with unaffected areas being clear
- Opacities composed of hyaline
- Opacities have flaky, crumb-like appearance

198 **Granular Dystrophy**

- Diagnosis made by clinical findings
- Some patients are asymptomatic, some develop RCEs
- Some require penetrating keratoplasty to achieve good vision
- Granules can recur superficially in graft

199 **Macular Dystrophy**

- Autosomal recessive
- Faint white anterior stromal opacities
- Usually seen in first decade of life
- Opacities tend to be progressive
- Results in limbus to limbus, ground glass haze between opacities

200 **Macular Dystrophy**

- Mucopolysaccharide deposits
- Caused by a metabolic abnormality in keratin sulfate
- Decreased visual acuity and photophobia common by second and third decade
- Usually requires penetrating keratoplasty by fourth decade
  - Usually have good outcome and recurrence in graft is rare

201 **Macular Dystrophy**

- Two distinct forms of the disease, Type I and Type II.
- Clinically these are indistinguishable.

202 **Fitting Considerations for Corneal Dystrophies**

- Treatment usually involves management of patient symptoms during acute episodes of corneal compromise
- Bandage contact lenses crucial for RCEs secondary to these conditions
- Constant monitoring extremely important when bandage contact lens is on the eye
  - 24 hour rule for bandage contact lenses
- Treatment may also involve use of specialty lenses to manage corneal irregularity
  - Corneal Transplants and scarring are most common
-

203 **Bandage Contact Lenses**

- Provides mechanical barrier
- May delay need for more invasive treatment
- High dK material is a necessity
- Currently four lenses approved for use as bandage lens
  - Acuvue Oasys
  - B&L Pure Vision
  - Air Optix Night & Day
  - UCL 55% (United Contact Lens)

204 **Bandage Contact Lenses**

- Protection
  - Mechanical barrier
  - Improved patient comfort
- Dehydration
  - Pervaporation can help "dry out" the healing defect
  - Pervaporation is evaporation or loss of fluid through a semi-permeable membrane
- Vision
  - Provides functional vision while eye is healing

205 **Bandage Contact Lenses**

- Fit of lens crucial to success
- Lenses should not have excessive movement
- Should center well and provide limbus to limbus coverage
- Lens power can be selected to provide good vision while lens is worn
  - Lens thickness and oxygen transmission must be considered
- Must reassess frequently to monitor healing process
- RGP lenses generally not a good option

206 **Questions?**

207 **References**

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