CONTACT LENS UPDATE AND REVIEW

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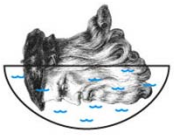
FINANCIAL DISCLOSURES

OBJECTIVES

- Described a variety of uses for contact lenses
- Discuss the complications associated with contact lenses
- Discuss the present and future advances in contact lenses

HISTORY OF CONTACT LENSES



1508

Leonardo da Vinci speculated that submerging one's head in a bowl of water could alter vision in his "Codex of the Eye." The solution proved less than practical because, you know, breathing.

1636

René Descartes places a glass tube filled with liquid in direct contact with the cornea; contact lenses get their name. Great name, terrible solution.

1801

Thomas Young reduced the size of the glass tube to ¼ inch and used wax to stick the water-filled lenses to his eyeballs. While we admire his advances in the technology, we're forced to respond with, "Yikes."

1845

Sir John Herschel entertains the idea of using contact lenses to correct the refraction errors that cause nearsightedness, farsightedness, and astigmatism. Way to go, Sir John.

EARLY 1880s

Dr. Fick and colleagues invent the first contact lens with refractive power for visual improvement; contact lens wearers can blink. Progress!

1929

Dr. Dallos and Istvan Komàromy perfected a method of making molds from living eyes. Cool, but ew.

1948

Optical technician Kevin Touhy unintentionally created the corneal lens when sanding down a plastic lens. Yay for happy accidents.

1960

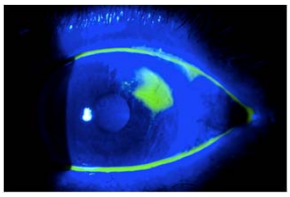
Bausch and Lomb refined the technique of casting hydrogel, which produced consistent lens surfaces and a process for mass production.

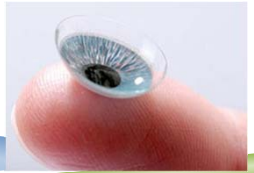
HISTORY OF CONTACT LENSES

- 1979 — The introduction of rigid gas permeable contact lenses
- 1981 — The introduction of soft extended wear contact
- 1982 — The launch of soft bifocal contacts
- 1986 — The introduction of extended wear GP contact lenses
- 1987 — The launch of disposable contact lenses
- 1995 — The introduction of daily disposable contact lenses
- 1999 — The introduction of silicon hydrogel contact lenses
- 2002 — Silicone hydrogel contact lenses first marketed in U.S.
- 2010 — Custom-manufactured silicone hydrogel in U.S.

USES FOR CONTACT LENSES

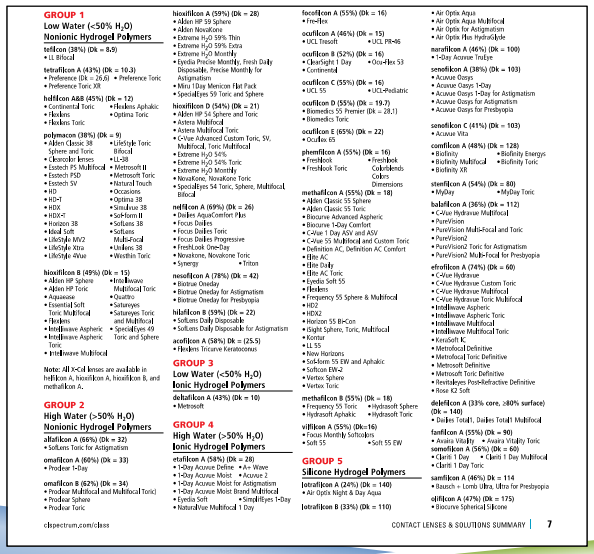
- Refractive Error
  - Especially helpful for high refractive errors
  - Anisometropia
- Bandage Contact Lens
  - Abrasions
  - Recurrent Corneal Erosion
  - Dry eye
- Irregular Corneas
  - Keratoconus
  - Post-surgical
  - Corneal Scarring
- Ocular Surface Disease
- Costmetic





IMPORTANT PROPERTIES OF LENS MATERIALS

- Dk
  - Measurement of how much oxygen passes thru a lens
  - Oxygen transmissibility
  - Varies on lens thickness
- Water Content
  - Higher H_2O = higher Dk



GROUP 1
Low Water (<50% H_2O)
Nonionic Hydrogel Polymers

nelfilcon (38%) (Dk = 8.9)
• LL Bifocal

tetrafilcon A (43%) (Dk = 10.3)
• Preference (Dk = 26.8) • Preference Toric
• Preference Toric XR

hafilcon A&B (45%) (Dk = 12)
• Continental Toric • Flexlens Aphakic
• Flexlens • Optima Toric
• Flexlens Toric

polymacon (38%) (Dk = 9)
• Ahlen Classic 38 • Lifestyle Toric
Sphere and Toric Bifocal
• Chromaflex Lenses • LL-38
• Essteck PS Multifocal • Metrosoft H
• Essteck PSD • Metrosoft Toric
• Essteck SV • Natural Touch
• H3 • Occasions
• H3-T • Optima 38
• H3X • Simulvue 38
• H3X-C • Soft-Form H
• Horizon 38 • Softlens 38
• Hoval Soft • Softlens
• Lifestyle MV2 Multi-Focal
• Lifestyle Xtra • Unilens 38
• Lifestyle Xtra • Wichtlin Toric

hioxifilcon B (49%) (Dk = 15)
• Ahlen HP Sphere • IntelliWave
• Ahlen HP Toric Multifocal Toric
• Aquawave • Quattro
• Essential Soft • Saturnyes
Toric Multifocal • Saturnyes Toric
• Flexlens and Multifocal
• IntelliWave Aspheric • SpectaEyes 49
• IntelliWave Aspheric Toric and Sphere
Toric
• IntelliWave Multifocal

Note: All X-Cel lenses are available in hefilcon A, hioxifilcon A, hioxifilcon B, and methafilcon A.

GROUP 2
High Water (>50% H_2O)
Nonionic Hydrogel Polymers

alfafilcon A (68%) (Dk = 32)
• Softlens Toric for Astigmatism

omafilcon A (60%) (Dk = 33)
• Proclear 1-Day

omafilcon B (62%) (Dk = 34)
• Proclear Multifocal and Multifocal Toric)
• Proclear Sphere
• Proclear Toric

hioxifilcon A (59%) (Dk = 28)
• Ahlen HP 59 Sphere
• Ahlen NovaKone
• Extreme H_2O 59% Thin
• Extreme H_2O 59% Extra
• Extreme H_2O Monthly
• Eyedia Precise Monthly, Fresh Daily Disposable, Precise Monthly for Astigmatism
• Miru 1 Day Menicon Flat Pack
• SpectaEyes 59 Toric and Sphere

hioxifilcon D (54%) (Dk = 21)
• Ahlen HP 54 Sphere and Toric
• Astera Multifocal
• Astera Multifocal Toric
• C-Vue Advanced Custom Toric, SV, Multifocal, Toric Multifocal
• Extreme H_2O 54%
• Extreme H_2O 54% Toric
• Extreme H_2O Monthly
• NovaKone, NovaKonc Toric
• SpectaEyes 54 Toric, Sphere, Multifocal, Bifocal

nelfilcon A (69%) (Dk = 26)
• Dailies AquaComfort Plus
• Focus Dailies
• Focus Dailies Toric
• Focus Dailies Progressive
• FreshLook One-Day
• Nexakone, NovaKone Toric
• Synergy • Triton

nesofilcon A (78%) (Dk = 42)
• Biotrue Oneday
• Biotrue Oneday for Astigmatism
• Biotrue Oneday for Presbyopia

hilafilcon B (59%) (Dk = 22)
• Softlens Daily Disposable
• Softlens Daily Disposable for Astigmatism

acofilcon A (58%) Dk = (25.5)
• Flexlens Tricurve Keratoconus

GROUP 3
Low Water (<50% H_2O)
Ionic Hydrogel Polymers

deltafilcon A (43%) (Dk = 16)
• Metrosoft

GROUP 4
High Water (>50% H_2O)
Ionic Hydrogel Polymers

etafilcon A (58%) (Dk = 28)
• 1-Day Acuvue Define • A+ Wave
• 1-Day Acuvue Moist • Acuvue 2
• 1-Day Acuvue Moist for Astigmatism
• 1-Day Acuvue Moist Brand Multifocal
• Eyedia Soft • SmartEyes 1-Day
• NaturalVue Multifocal 1 Day

focofilcon A (55%) (Dk = 16)
• Fre-flex

ocufilcon A (46%) (Dk = 15)
• UCL Trisoft • UCL PR-46

ocufilcon B (52%) (Dk = 16)
• Clearlight 1 Day • Ocu-Flex 53
• Continental

ocufilcon C (55%) (Dk = 16)
• UCL 55 • UCL-Pediatric

ocufilcon D (55%) (Dk = 19.7)
• Biomedics 55 Premier (Dk = 28.1)
• Biomedics Toric

ocufilcon E (65%) (Dk = 22)
• Ocuflex 65

phemfilcon A (55%) (Dk = 16)
• FreshLook • FreshLook
• FreshLook Toric Colorblends
Colors
Dimensions

methafilcon A (55%) (Dk = 18)
• Ahlen Classic 55 Sphere
• Ahlen Classic 55 Toric
• Biocune Advanced Aspheric
• Biocune 1-Day Comfort
• C-Vue 1 Day ADV and ASV
• C-Vue 55 Multifocal and Custom Toric
• Definition AC, Definition AC Comfort
• Elite AC
• Elite Daily
• Elite AC Toric
• Eyedia Soft 55
• Flexlens
• Frequency 55 Sphere & Multifocal
• HD2
• HDX2
• Horizon 55 Bi-Con
• Night Sphere, Toric, Multifocal
• Kontur
• LL 55
• New Horizons
• Soft-form 55 EW and Aphakic
• Softcon EW-2
• Vertex Sphere
• Vertex Toric

methafilcon B (55%) (Dk = 18)
• Frequency 55 Toric • Hydrosoft Sphere
• Hydrosoft Aphakic • Hydrosoft Toric

vifilcon A (55%) (Dk=16)
• Focus Monthly Softcolors
• Soft 55 • Soft 55 EW

GROUP 5
Silicone Hydrogel Polymers

lotrafilcon A (24%) (Dk = 140)
• Air Optix Night & Day Aqua

lotrafilcon B (33%) (Dk = 110)
• Air Optix Aqua
• Air Optix Aqua Multifocal
• Air Optix for Astigmatism
• Air Optix Plus HydraGlyde

narafilcon A (46%) (Dk = 100)
• 1-Day Acuvue TruEye

senofilcon A (38%) (Dk = 103)
• Acuvue Oasys
• Acuvue Oasys 1-Day
• Acuvue Oasys 1-Day for Astigmatism
• Acuvue Oasys for Astigmatism
• Acuvue Oasys for Presbyopia

senofilcon C (41%) (Dk = 103)
• Acuvue Vita

comfilcon A (48%) (Dk = 128)
• Biofinity • Biofinity Energys
• Biofinity Multifocal • Biofinity Toric
• Biofinity XR

stenfilcon A (54%) (Dk = 80)
• MyDay • MyDay Toric

balafilcon A (36%) (Dk = 112)
• C-Vue Hydravue Multifocal
• PureVision
• PureVision Multi-Focal and Toric
• PureVision2
• PureVision2 Toric for Astigmatism
• PureVision2 Multi-Focal for Presbyopia

efrofilcon A (74%) (Dk = 60)
• C-Vue Hydravue
• C-Vue Hydravue Custom Toric
• C-Vue Hydravue Multifocal
• C-Vue Hydravue Toric Multifocal
• IntelliWave Aspheric
• IntelliWave Aspheric Toric
• IntelliWave Multifocal
• IntelliWave Multifocal Toric
• KeraSoft IC
• Metrofocal Definitive
• Metrofocal Toric Definitive
• Metrosoft Definitive
• Metrosoft Toric Definitive
• Restalyses PrioRefractive Definitive
• Rose K2 Soft

delefilcon A (33% core, ≥80% surface) (Dk = 140)
• Dailies Total1, Dailies Total1 Multifocal

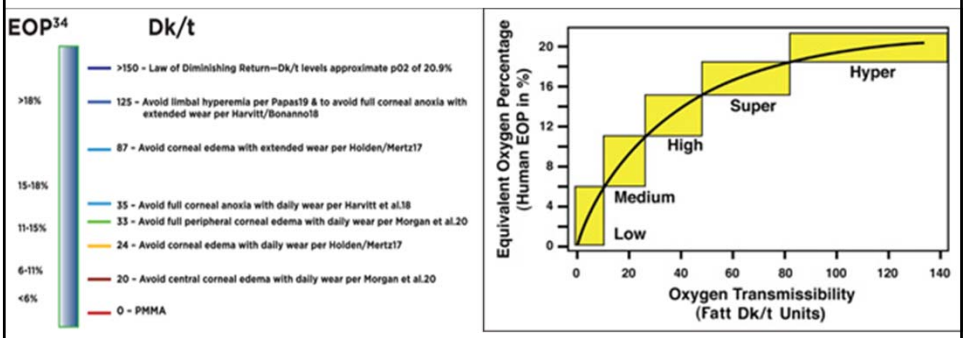
fanfilcon A (55%) (Dk = 90)
• Avaira Vitality • Avaira Vitality Toric

somofilcon A (56%) (Dk = 60)
• Clariti 1 Day • Clariti 1 Day Multifocal
• Clariti 1 Day Toric

samfilcon A (46%) Dk = 114
• Bausch + Lomb Ultra, Ultra for Presbyopia

qlfilcon A (47%) (Dk = 175)
• Biocune Spherical Silicone

LENS MATERIALS



Dk – measurement of how much oxygen passes through a contact lens

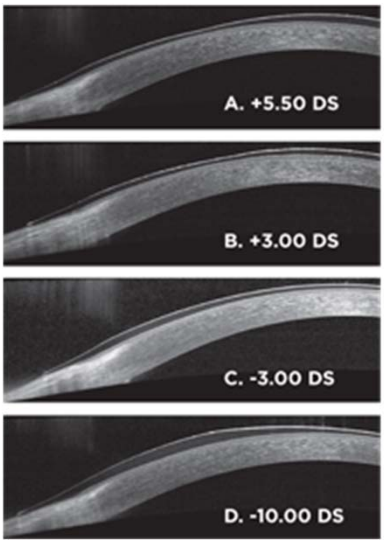
DK FOR COMMONLY PRESCRIBED LENSES

Lens	Dk	Water Content
Dailies AquaComfort Plus	26	69%
1-Day Acuvue Moist	28	58%
Acuvue 2	28	58%
Proclear	34	62%
Acuvue Oasys	103	38%
Acuvue Vita	103	41%
Air Optix Aqua	110	33%
PureVision	112	36%
Ultra	114	46%
Biofinity	128	48%
Dailies Total 1	140	33% core; >80% surface
Night and Day	140	24%

LENS THICKNESS

- High minus = thicker edge
- High plus = thicker center

- Dk/T
  - T = Lens Thickness
  - Higher thickness = less oxygen transmission

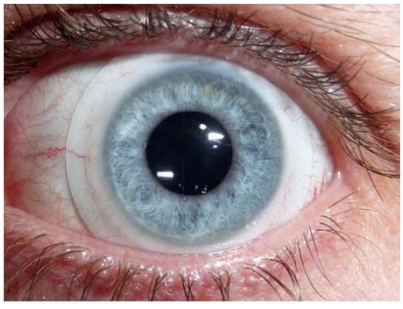


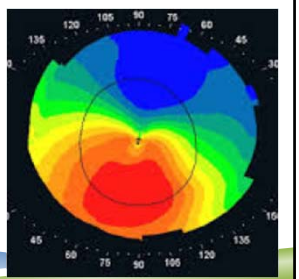
SILICONE HYDROGELS

- Silicone Hydrogel
  - Advantages
    - High Dk
    - Less hypoxia
    - Extended Wear
    - Comfort?
  - Disadvantages
    - Less wettability
    - Higher modulus
    - Cost
    - GPC

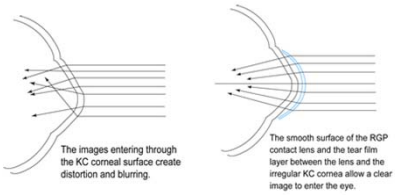
SCLERAL LENSES

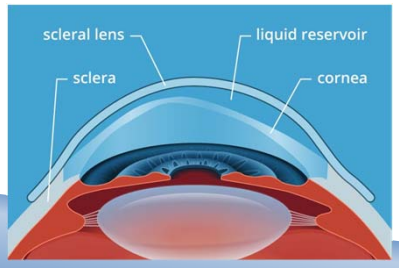
- Benefits
  - Better comfort
  - More stability
  - Visual acuity
  - Advanced irregularity
- Fitting
  - Central clearance
  - Limbal fit
  - Edge
- Wear and care





WHY RGP AND SCLERAL LENSES?





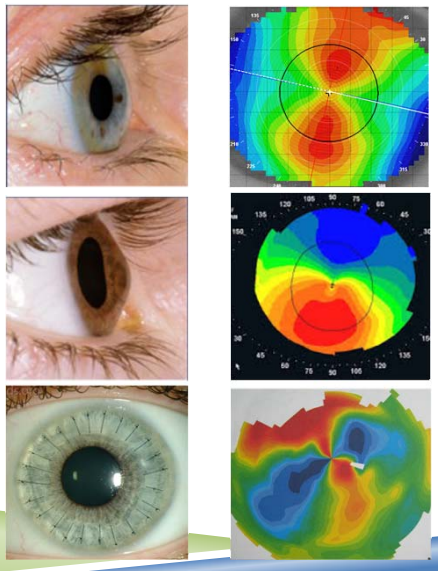
- The scleral lens allows a reservoir of tears to form between the irregular cornea and the scleral lens
- This provides a more regular refractive surface and better vision

COMPARING CORNEAS

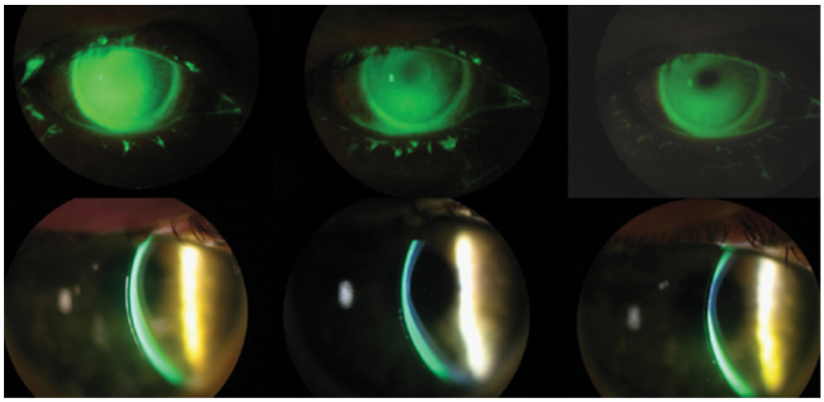
Normal Cornea
- Bow-tie pattern
- Superior = Inferior

Keratoconus
- Inferior steepening
- Superior ≠ Inferior

Corneal Transplant
- Varying irregularity



SCLERAL LENS FITTING



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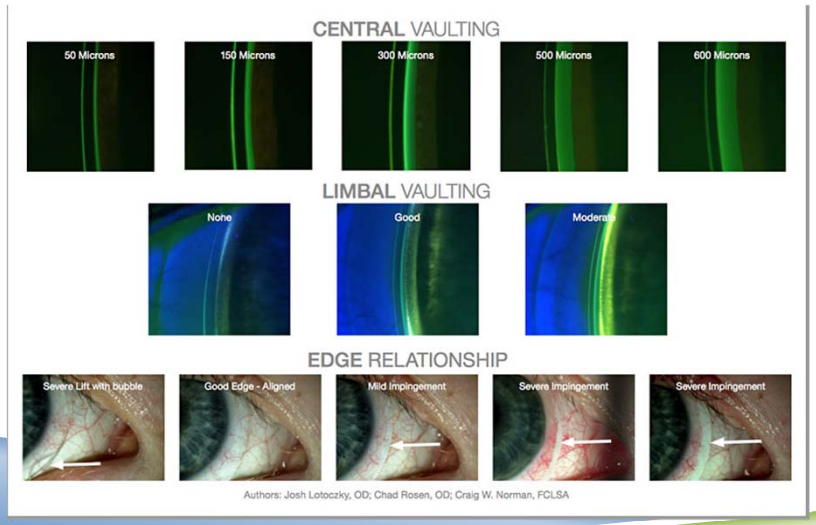

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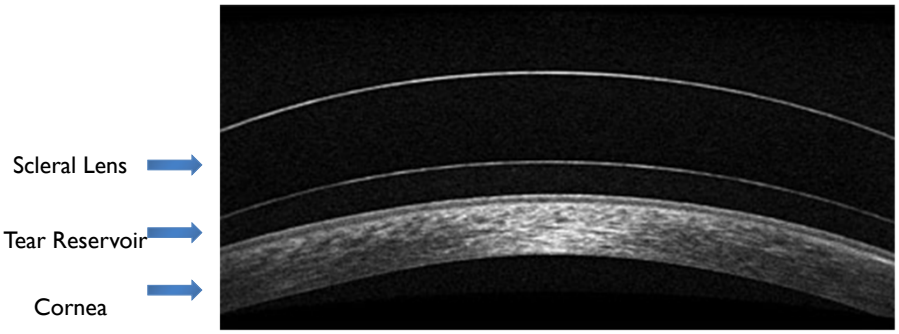
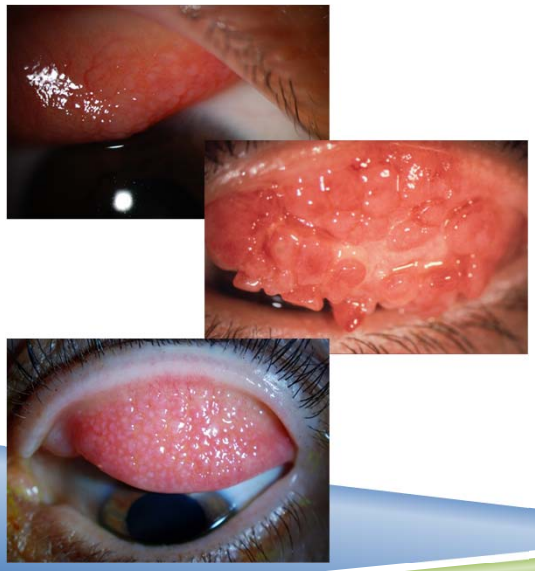


CONTACT LENS COMPLICATIONS

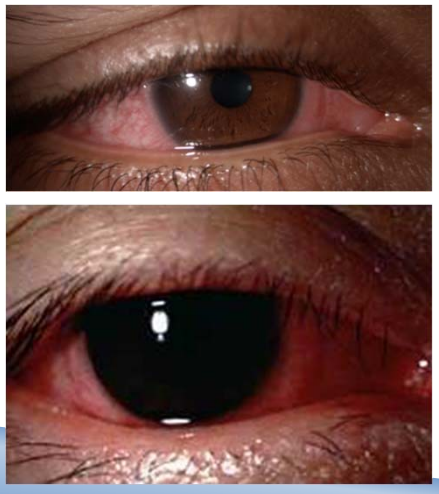
- GPC
- CLARE
- Contact Lens induced infiltrate
- Bacterial keratitis
- Acanthomoeba

GIANT PAPILLARY CONJUNCTIVITIS



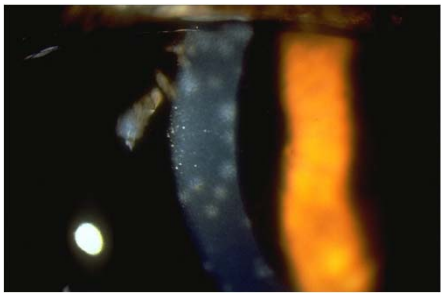
- Allergic conjunctivitis caused by mechanical irritation
- More common in SiHy lenses
- Symptoms
  - Irritation both with and without conta lens present
  - Excessive lens movement
- Treatment
  - Mild – anti allergy drops
  - Severe – Steroid
- Prevention
  - H_2O_2 Solution
  - Daily allergy drop
  - Daily disposable lenses

CONTACT LENS ACUTE RED EYE – CLARE



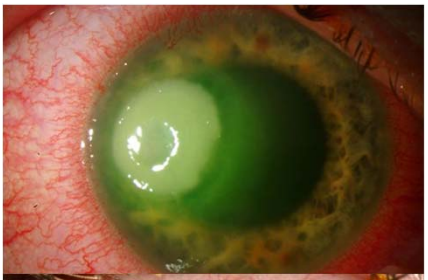
- Inflammatory reaction (not infectious!)
- Symptoms
  - Pain
  - Redness
  - Watering
  - Photophobia
- Treatment
  - Antibiotic and steroid combo
  - D/C contact lens wear
- Prevention
  - Improve compliance
  - Higher D/k lens

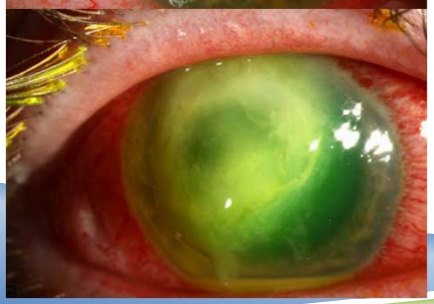
CORNEAL INFILTRATE



- Hypoxia, hypersensitivity
- Inflammatory (not infectious!)
- Symptoms
  - Pain
  - Redness
  - Watering
  - Photophobia
- Treatment
  - Antibiotic and steroid combo
  - D/C contact lens wear
- Prevention
  - Improve compliance
  - Higher D/k lens

BACTERIAL KERATITIS

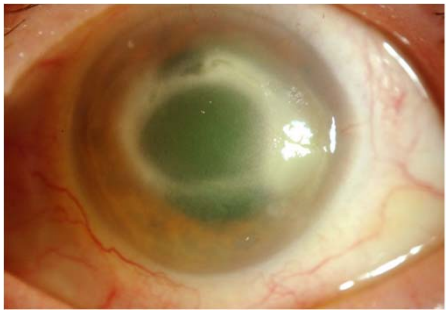




- Cause
  - *Pseudomonas aeruginosa*
  - *S. aureus, S. epidermidis, S. pneumoniae*
  - *Moraxella*
- Treatment
  - Culture
  - Aggressive antibiotics
    - Fluoroquinolone
    - Fortified
- Prognosis
  - depends on extent and location of infection

ACANTHOMOEBA KERATITIS

- Cause
  - *Acanthamoeba*
- Treatment
  - Topical antiamoebics
  - Topical antibiotics
  - Prevention!
- Prognosis
  - Ranges from complete recovery to corneal transplant



CURRENT AND FUTURE ADVANCEMENTS

- Extending Range of SiHy Lenses
- Transitions
- Selenium infused lenses
- Medication Delivery
- Glucose monitoring