

Refractive Surgery Complications and How To Deal With Them

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Dry Eye - Most common Complication

- Cause:
 - Disruption of corneal nerves = decreased tear production
 - Goblet cell damage from pressure during flap creation
 - Change in corneal curvature
 - Changes how the tear film covers the cornea
 - More significant in hyperopic treatments

Eric Polk, O.D. and Paul M. Karpecki, O.D. Review of Optometry. 9th Annual Dry Eye Report: Erase the Dryness after LASIK. 2008

Dry Eye & LASIK

- ▶ Pubmed Search yielded 164 citations
- ▶ Surprisingly few studies on risk factors or predicting post-op dry eye
- ▶ The majority were related to treatment of dry eye, editorials, reviews or to very specific issues such as hinge position

Schallhorn N = 32,070

- Dry eye is the most common side-effect of LVC (11.3% at 3M)
- Symptoms are related to patient dissatisfaction
- There are predictive factors:

Strongly predictive

- › Gender – Females
- › Procedure type – PRK
- › Preop Rx – Hyperopia

Statistically significant, but little/no predictive contribution

- › Age
- › TBUT
- › SPK
- › Ablation depth
- › Flap type

Dry Eye & LVC

- Significant dry eye and ocular symptoms are rare 12 months after LASIK about 7% representing a return to baseline
- Even at 12M, dry eye is related to procedure satisfaction
- Younger, lower hyperopes have the most dry eye complaints
- Older, higher hyperopes have the least dry eye complaints

Dry Eye & LVC

- › Age is not an independent predictor
- › LASIK reduces the risk vs PRK
- › Hyperopic females with dry eye symptoms before surgery and undergo PRK are at a much higher risk
- › LASIK in asymptomatic hyperopic females reduces the risk
- › Hyperopic males who undergo LASIK have a lower risk than the general population

Dry Eye – Most common Complication

- 85% at 1 week post-op¹
- 60% at 1 month post-op¹
- 11.3% at 3 months post-op²
- Return to baseline by 12 months³

1- Eric Polk, O.D., and Paul M. Karpecki, O.D. Review of Optometry, 9th Annual Dry Eye Report: Erase the Dryness after LASIK, Feb 2008
2- Schaflhorn – Optical Express Data
3- Murakami, et al, Ophthalmology 2012

Dry Eye Management – Post-op

- ▶ Artificial tears at least qid (1–6 months)
 - Patients often present initially with NO symptoms.
 - Temporary neurotrophic effect of flap creation.
 - Reaffirm need for lubrication
- ▶ Punctal occlusion
 - Extended duration collagen plugs
- ▶ Cyclosporine 0.05 % (Restasis)

Meibomitis

- ▶ Reduce TBUT
- ▶ CL intolerance
- ▶ Azasite bid applied to lid margins
- ▶ Doxycycline 20mg, 50mg, 100mg
- ▶ Rx 100mg bid RTO 4–6 weeks
- ▶ If better 100 mg qd RTO 4–6 week
- ▶ If better 50 mg qd RTO 4–6 weeks



Dry Eye Pre-treatment

- ▶ Modify environment, medications, habits
- ▶ Artificial tears - drops, gels, ointments
- ▶ Topical Cyclosporin
- ▶ Topical Steroids
- ▶ Nutritional supplements
- ▶ Punctal occlusion

Dry Eye Pre-treatment Goal

- ▶ Minimal Symptoms
- ▶ No SPK
- ▶ Stable refraction
- ▶ Stable aberrometry
- ▶ Stable topography

RS

- ▶ 31 year old male
- ▶ 12 hours S/P uneventful LASIK OU
- ▶ Patient phones with complaints of discomfort OU

“My right eye became very uncomfortable about an hour after I got home and the vision is much better currently in my left eye.”

What do you tell patient

1. Go back to sleep the eye should feel better in the morning
2. Take another vicodin, that should help the pain
3. RTO now
4. Lubricate your eye and we will check you in the AM

LASIK What to Look for at Each Post Op

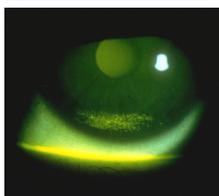
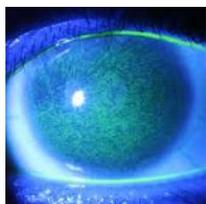
- ▶ LASIK Post Op Examination:
 - Flap:
 - Position: excellent, dislodged, striae, centered?
 - Clarity: clear, edema, haze?
 - Interface: clear, opacities, epithelial ingrowth?
 - Edges: smooth, rolled, eroded?
 - Interface Material
 - Debris
 - Epithelial cells/ingrowth
 - Diffuse Lamellar Keratitis (SOS)

Day 1

S/P myopic Lasik
UCVA OD 20/30
OS 20/20

Slit Lamp Evaluation
OD SPK central 1-2+
OS SPK inferior trace

What do you tell the patient?
What is the treatment?



What do you tell the patient

- A. You have a complication, both eyes are dry
- B. All patients have some dryness as they heal from LASIK surgery
- C. The dryness is causing your vision to fluctuate
- D. Older patients always have dry eyes

What is the treatment

- A. No change with drops
- B. Increase artificial tears PF q1h OU
- C. Add Restais bid OU (if not already)
- D. Discontinue the steroid

Day One Pearls – Critical Timing

CLINICAL TESTS

- ▶ Celebration!!
- ▶ History
- ▶ UCVA OD/OS
- ▶ Slit lamp
Biomicroscopy
- ▶ Review drops /
instructions
- ▶ RTO 3–5 days

CLINICAL FINDINGS

- ▶ Dislodged flap*
- ▶ Flap Striae*
- ▶ Infiltrate/Infection*
- ▶ DLK “SOS”
- ▶ SPK
- ▶ Poor UCVA
- ▶ * Return to Surgery Center

3-5 Days Pearls – Critical Timing

CLINICAL TESTS	CLINICAL FINDINGS
<ul style="list-style-type: none">HistoryUCVA OD/OSDry Refraction: BCVA<ul style="list-style-type: none">Only if UCVA < 20/20Slit lamp Biomicroscopy<ul style="list-style-type: none">NaFl if indicatedInstructions/Discontinue medicationsPatient reassuranceRTO 3 weeksResume most activities and make-up	<ul style="list-style-type: none">Flap StriaeDLK “SOS”Infiltrate/Infection*Epithelial ingrowthSPKRefractive errorLoss of BCVA*

* Return to Surgery center

1 Month Pearls – Critical Timing

CLINICAL TESTS	CLINICAL FINDINGS
<ul style="list-style-type: none">HistoryUCVA OD/OSDry Rx BCVA only if UCVA < 20/20Slit lamp BiomicroscopyInstructions, RTO 2 months	<ul style="list-style-type: none">Flap StriaeEpithelial ingrowthSPKRefractive errorLoss of BCVA*

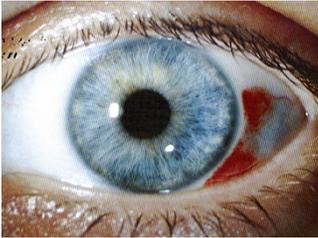
* Return to Surgery Center

3,6,12 Month Post-op Pearls

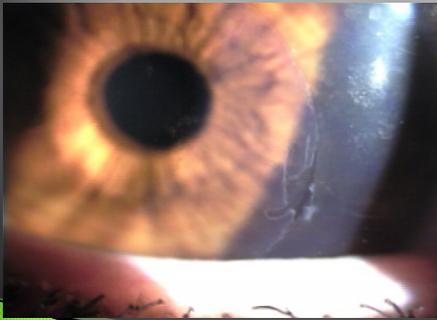
CLINICAL TESTS	CLINICAL FINDINGS
<ul style="list-style-type: none">HistoryUCVA OD/OSDry Rx BCVA at 3 month only (nomogram)Slit lamp biomicroscopyInstructions, RTO 3-6 months	<ul style="list-style-type: none">Epithelial ingrowthSPKRefractive errorFlap StriaeLoss of BCVA*

*Return to Surgery Center

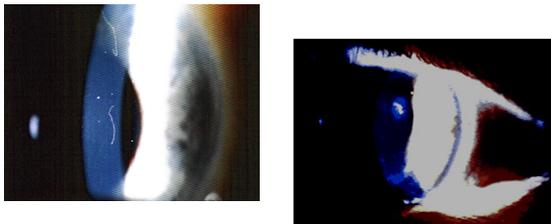
Subconjunctival Hemorrhages
common findings on the 1 day post op LASIK patient



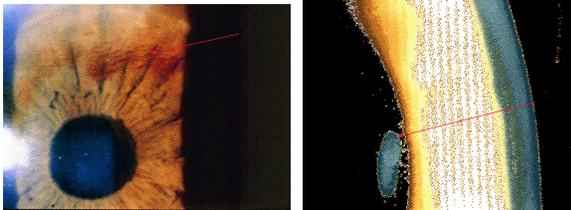
Epithelial Defect



Interface Debris



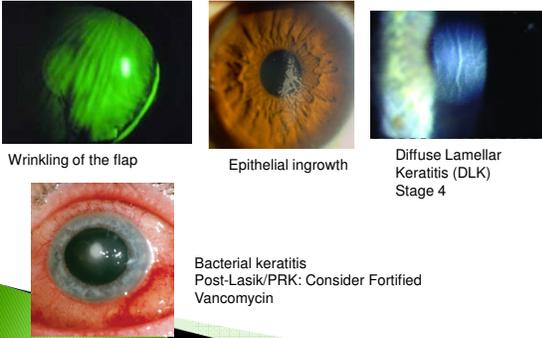
Interface Debris



Red Blood Cells in the interface. Meibomian oil droplets in interface.

Neither are permanent
Neither cause a visual problem

Watch for...

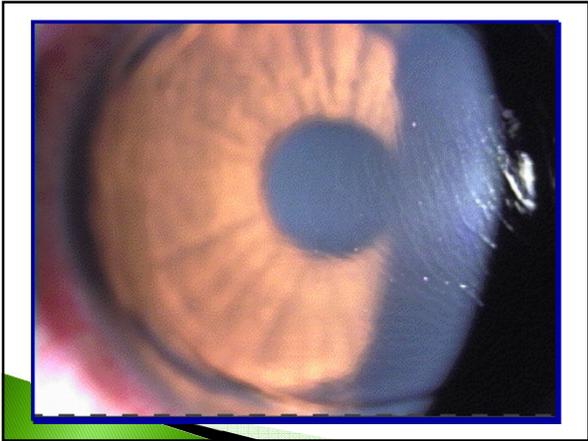


Wrinkling of the flap Epithelial ingrowth Diffuse Lamellar Keratitis (DLK) Stage 4

Bacterial keratitis
Post-Lasik/PRK: Consider Fortified Vancomycin

Patient RS

- ▶ 31 year old male
- ▶ 12 hours S/P uneventful LASIK OU
- ▶ Patient phones with complaints of discomfort OU
- ▶ "My right eye became very uncomfortable about an hour after I got home and the vision is much better currently in my left eye."



When should patient RS return to the clinic?

- ▶ Immediately
- ▶ Diagnosis: Wrinkled/Dislodged/Slipped Flap
- ▶ Plan:
 - Return to surgeon to lift and smooth flap
 - Can temporarily place a bandage contact on the eye

Patient AB

- ▶ 25 year old female
- ▶ 1 week S/P bilateral LASIK
- ▶ Painless reduced VA in left eye since surgery
- ▶ "My vision just isn't as good out of my left eye as I hoped it would be. I am seeing a lot of glare at night."

What test would you perform on patient AB at the 1 week post op visit?

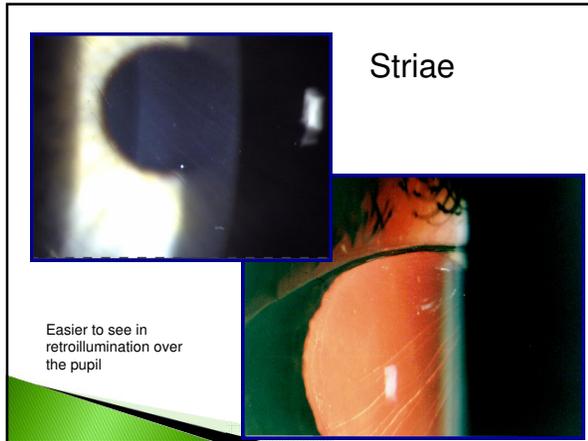
- A. UCVA OD and OS
- B. Refraction and BCVA OD and OS
- C. Slit lamp biomicroscopy
- D. Tonometry
- E. Dilate pupil
- F. NaFl instillation

What test would you perform on patient AB at the 1 week post op visit?

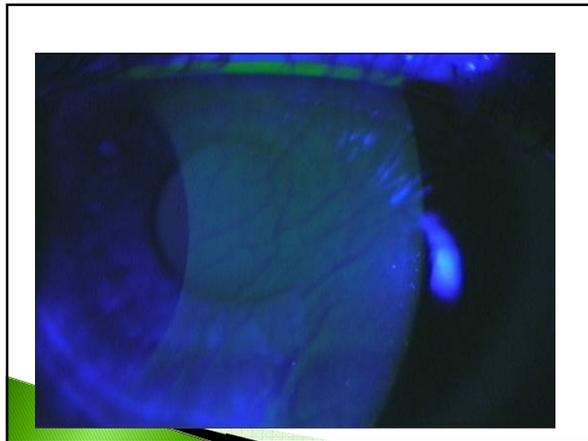
- A. UCVA OD and OS
- B. Refraction and BCVA OD and OS
- C. Slit lamp biomicroscopy
- D. Tonometry
- E. Dilate pupil
- F. NaFl instillation

Differential Diagnosis

- ▶ Flap Striae
- ▶ SPK/DES
- ▶ Residual refractive error
- ▶ DLK
- ▶ Infection (expect pain)
- ▶ Epithelial ingrowth (rare at 1 week)







Flap Microstriae

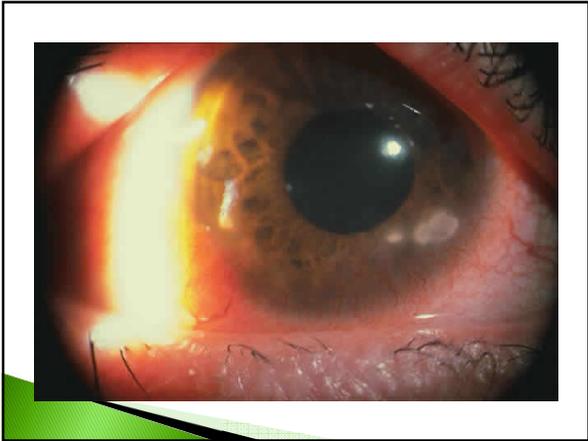
- ▶ Often not visible at 1-day check
- ▶ Onset 24- 72 hours
- ▶ Will NOT resolve without treatment
- ▶ Common with high myopia
- ▶ Common with deep ablations
- ▶ Usually find small amounts of mixed astigmatism
- ▶ **Only significant if have a loss of BCVA or a subjective complaint in the quality of vision (night glare/halo)**

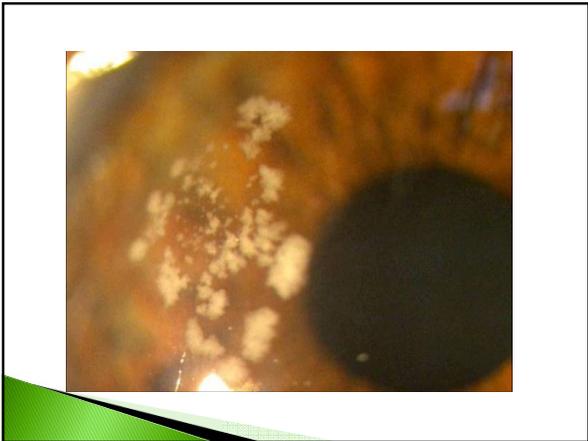
Treatment

- ▶ If treatment is necessary: flap lift and stretch
- ▶ The sooner the better

Patient MN

- ▶ 25YOM 2 days s/p bilateral Lasik
- ▶ "My right eye hurts and is sensitive to the light. My vision is getting blurry in the right eye. My left eye feels fine."
- ▶ When should you see this patient?
 - Immediately







Plan:

- ▶ Call your Refractive Surgery Center!!!
- ▶ Increase antibiotic (Zymaxid q1 h)
- ▶ Add fortified antibiotic (Vancomycin)
- ▶ D/C Steroid
- ▶ Lift flap and culture
- ▶ Follow daily until resolution
 - (1- 2 visits per day)
- ▶ Long-term
 - Flap smoothing
 - PTK
 - Flap removal
 - PK

Patient TS

- ▶ 42 year old male
- ▶ Right eye is sore to the touch since LASIK enhancement 1 month ago
- ▶ Vision has declined in the right eye over the past week

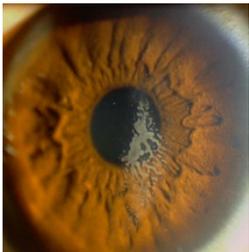
What tests would you perform on TS at the 1 month PO visit?

- A. UCVA in OD and OS
- B. Refraction and BCVA in OD and OS
- C. Slit lamp biomicroscopy OU
- D. NaFl instillation OU
- E. Tonometry OU (only if necessary)
- F. Corneal topography OU (only if necessary)
- G. Wavefront Aberrometry (only if necessary)



Diagnosis?

- ▶ Epithelial ingrowth

A clinical photograph of a human eye. The iris is brown and the pupil is dark. There is a visible area of epithelial ingrowth on the cornea, appearing as a white, fibrous, and irregularly shaped area near the pupil.

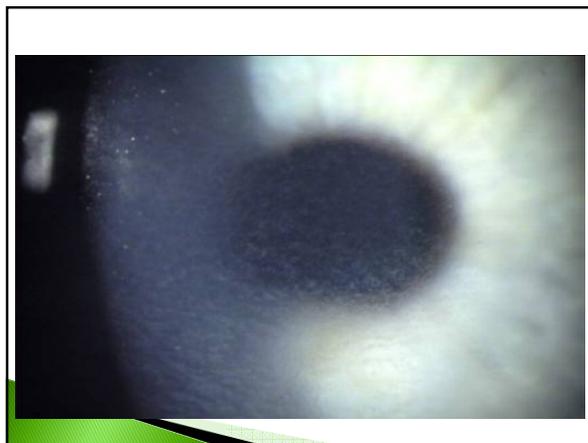
What are good reasons to treat Epithelial ingrowth?

- Epithelial cells within pupil with decreased BCVA
- Persistent flap edge staining with NaFl
- Progressive refraction or topographic changes
- Flap melt
- Persistent sore eye
- Day time glare symptoms

The majority of epi ingrowth does not need to be treated

Patient CC

- ▶ 40 year old female
- ▶ S/P bilateral LASIK x 1 week
- ▶ Patient reports a mild scratchy feeling that is getting worse.
- ▶ Slitlamp biomicroscopy reveals "cloudy haze in right cornea"



Diffuse Lamellar Keratitis (DLK)

- ▶ Begins in the periphery in the flap interface
- ▶ Looks like white "sand" particles
- ▶ Typically unilateral
- ▶ Tend to occur in outbreaks/sequential patients
- ▶ Looks like whitish sand underneath the flap
- ▶ Typically noted at day 1 or week 1 postoperative exams
- ▶ Can have late onset
 - Even years later, particularly after corneal trauma

Diffuse Lamellar Keratitis (DLK)

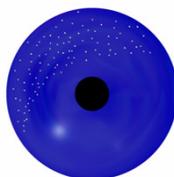
► Etiology: Unknown?

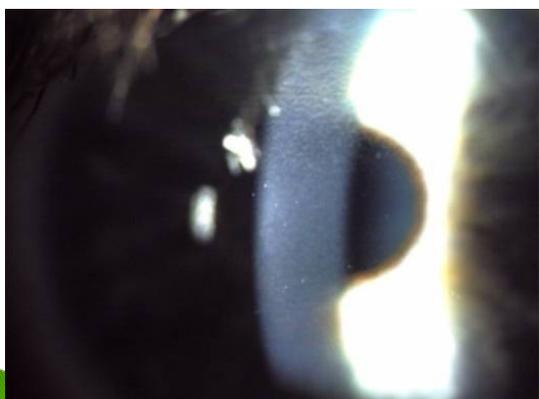
- Bacterial endotoxins in the autoclave reservoirs
 - Contaminated sterilizer reservoir
- Excessive corneal manipulation
- Mold or fungal contamination
- Trauma
- Excessive Intralase energy (Unlikely with current Intralase)
- Poor manufactured blades (Rarely used anymore)

► DLK is much less common now due to disposable instruments and Intralase.

	Grade 1 DLK
Signs/Symptoms	<ul style="list-style-type: none"> ► Focal, white/gray, granular material in the flap interface ► Normal VA
Treatment	<ul style="list-style-type: none"> ► Increase topical steroids q1h ► f/u every 1-3 days ► Taper steroid slowly (2-3 weeks)
Prognosis	► Excellent

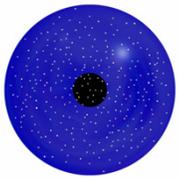
- Mild DLK may look similar to SPK, but SPK is on the surface and will stain with NaFL.
- Please report all DLK cases to your surgery center.

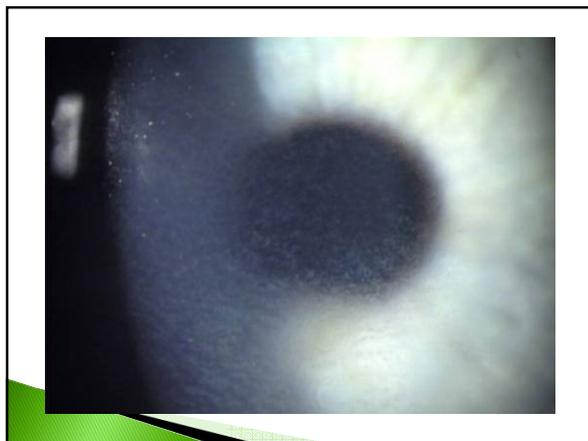




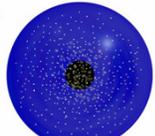
Grade 2 DLK	
Signs/Symptoms	<ul style="list-style-type: none"> ▶Diffuse, white/gray, granular material in the flap interface ▶Normal VA or reduced 1-2 lines ▶Mild discomfort
Treatment	<ul style="list-style-type: none"> ▶Increase topical steroids q1h ▶Interface irrigation (return to surgeon) ▶f/u every day
Prognosis	▶Excellent after interface irrigation

•IOP must be closely monitored during steroid treatment
 •If IOP ↑ Change to a "softer" steroid and add Glaucoma medications
 •Steroids are **not discontinued**



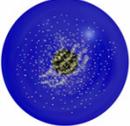


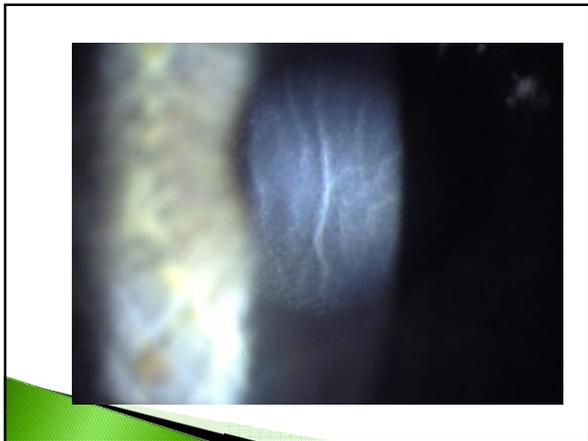
Grade 3 DLK	
Signs/Symptoms	<ul style="list-style-type: none"> ▶Diffuse, confluent, white/gray, granular material in the flap interface ▶Significantly reduced BCVA (hyperopic astigmatism) ▶Discomfort and possible conj injection
Treatment	<ul style="list-style-type: none"> ▶Should not get to this stage ▶Increase topical steroids q1h ▶Interface irrigation!! (return to surgeon) ▶f/u every day
Prognosis	▶Good after interface irrigation





Grade 4 DLK	
Signs/Symptoms	<ul style="list-style-type: none">›Diffuse,confluent, white/gray, granular material in the flap interface›Intense central inflammation›Significantly reduced BCVA (hyperopic astigmatism)›Discomfort and possible conj injection
Treatment	<ul style="list-style-type: none">›Should not get to this stage!!!›Increase topical steroids q1h›Interface irrigation!! (return to surgeon)›f/u every day
Prognosis	<ul style="list-style-type: none">›?? Possible reduced BCVA, irregular astigmatism, residual hyperopia

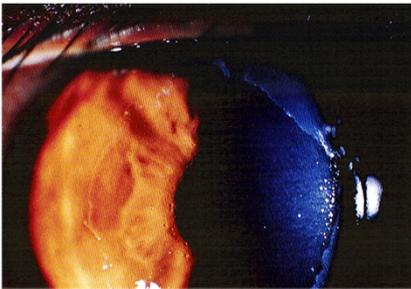




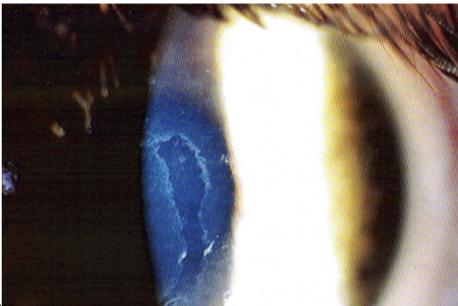
PRK Vision Expectations

- ▶ 20/40-20/80 Day 1
- ▶ 20/40-20/200 Days 2-4
- ▶ 20/30-20/80 Day 4-5
- ▶ VA rapidly improves 2-3 days after removal of BCL as epi thickens and smoothes
- ▶ Functional Vision at day 5-6
 - Expect to have driving vision
- ▶ Good vision at 1 week to 10 days
- ▶ Excellent vision at 4-6 weeks
- ▶ Healed at 6 months

24 hours post PRK \approx 15% healed



3-4 days post PRK \approx 80-90% healed



Bandage Contact Lens:

- ▶ Remove when epithelium is 100% closed
 - usually at day 4-5
- ▶ If in doubt: leave BCL in additional 1-2 days
- ▶ Can remove BCL (carefully!!) reassess epithelium and then replace with new BCL if necessary
 - Caution: may increase pain and slow healing
 - Always use an antibiotic if replace the BCL
- ▶ Avoid removing BCL to simply change it for a fresh lens because it looks "dirty"
- ▶ Refit BCL if too loose causing physical discomfort or too tight - "Overwear Syndrome"
- ▶ Let patient know that VA immediately after BCL removal may be worse or no change

Bandage Contact Lens:

- ▶ **When the epithelium is healed:**
 - Remove the contact lens - FLOAT - don't pull off the new epithelium
 - Have the patient use lubricating drops every minute for 5-10 minutes to "float" the lens if it does not freely move
 - The lens can then be removed by either gently dragging it inferiorly and pinching it off, or by using a forceps to remove at the slit lamp.
 - Avoid use of topical anesthesia
 - You want the patient to be able to tell you how the eye feels after the contact is removed

Re-epithelialization

- ▶ **99% of patients completely re-epithelialized by day 4 or 5**
- ▶ If epithelium not healed at 72 hrs:
 - Consider **Infection (MRSA) or Herpes Simplex**
 - Continue to monitor daily

Surface Ablation POST-OP REGIMEN

▶ During Epithelial Healing

- Antibiotic & steroid until epithelium healed
- NSAID bid X 2-4 days then D/C
- D/C antibiotic once epithelium is healed
- Topical anesthetic drops (only as an escape from pain, potentially can delay healing)
- Vitamin C 500mg bid

Typical Surface Ablation POST-OP REGIMEN

▶ Steroid Taper:

- 4 x day for 1 week
- 3 x day for 1 week
- 2 x day for 1 week
- 1 x day for 1 week

▶ Preservative Free Lubricants frequently

Surface Ablation Post-Operative Care

▶ Post Op Visit Schedule:

- **Daily**, until the Epithelium is filled in and the contact lens is removed
- **1- 2 weeks** after epithelium is healed
- **Months 1, 3, 6,**
- Enhancement if needed at 6 months or greater

Pain Control

- ▶ Cold (Ice packs)
- ▶ Topical NSAID
- ▶ Topical Anesthetics*
- ▶ Bandage Contact Lenses
- ▶ Oral Medications
 - NSAID
 - Steroids
 - Narcotics

Oral NSAID's – OTC

- ▶ **Pain Cocktail (Off-label)**
 - 225 mg Naproxin Sodium
 - 600mg Ibuprofen

1 Aleve + 3 Advil PO q8h

or

2 Aleve + 2 Advil PO q8h

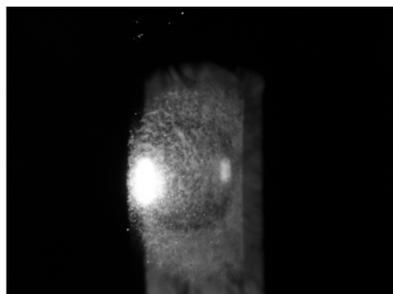
Anti-Convulsant

- ▶ **Pregabalin – Lyrica**
 - Similar to Neurontin
 - May have faster onset
 - **Schedule V**
 - 50mg, 75mg & 100mg CAPS
- ▶ **Dosage 75mg q6h PO**

Watch for...

- ▶ **Corneal haze**
 - Keratocytes become myofibroblasts to heal the corneal wound
 - Not transparent
 - Extra-cellular matrix is disorganized and denser which scatters light
 - Consider Vitamin C 500mg bid
 - Mitomycin C (MMC)
 - Allows for less haze
 - Developed as a chemotherapeutic agent
 - Acts to stop cells from proliferating by cross-linking DNA which modulates wound healing

Corneal Haze



Watch forCorneal Infection

Treat same as LASIK infection

