Two very broad categories of post-surgical issues
Two very broad categories of post-surgical issues
Three basic ways you can have a suboptimal visual outcome
Photoablative Surgery Issues

Optical Issues

- Overcorrection
- Undercorrection
- Aberrations

Three basic ways you can have a suboptimal visual outcome
What is the most common cause of overcorrection?
What is the most common cause of overcorrection?

Stromal moisture state
What is the most common cause of overcorrection?
Stromal dehydration
What is the most common cause of overcorrection?
Stromal dehydration

How does stromal dehydration lead to overcorrection?
What is the most common cause of overcorrection?
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How does stromal dehydration lead to overcorrection?
- If the stroma is dehydrated, it ablates more readily, and thus more tissue is removed per laser burst
What is the most common cause of overcorrection?
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What surgical factors are common causes of stromal dehydration?
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How does stromal dehydration lead to overcorrection?
If the stroma is dehydrated, it ablates more readily, and thus more tissue is removed per laser burst

What surgical factors are common causes of stromal dehydration?
--Allowing too much time to pass between denuding the epithelium/cutting the flap, and ablating the stroma
--Humidity and/or temperature in the excimer room being outside of the manufacturer’s recommendations
What is the most common cause of overcorrection?
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If a pt is overcorrected, how soon should surgical correction be undertaken?
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If a pt is overcorrected, how soon should surgical correction be undertaken?
As many pts experience some degree of spontaneous regression over the first 3-6 months, it is prudent to allow several months to pass before intervening
**Photoablative Surgery Issues**

- Optical Issues
  - Overcorrection
  - Undercorrection
  - Aberrations

What are the most common causes of undercorrection?

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What are the most common causes of undercorrection?
--High degrees of pre-op myopia or hyperopia
--Spontaneous regression
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What steps can be taken to reduce or even reverse regression leading to undercorrection?
-- ?
-- ?
What are the most common causes of undercorrection?
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What steps can be taken to reduce or even reverse regression leading to undercorrection?
--Use of MMC at the time of ablation
--Heavy topical steroid use in the post-op period if regression is noted to be ongoing
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If a pt is undercorrected, at what point should surgical correction be undertaken?
Once the refraction has stabilized, which usually takes at least [ ] months
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What other complication, if present, should prompt the surgeon to wait even longer?
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Post-op haze—if present, it portends a higher risk for further regression and/or haze formation
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If a pt is undercorrected, at what point should surgical correction be undertaken?
Once the refraction has stabilized, which usually takes at least 3 months

What other complication, if present, should prompt the surgeon to wait even longer?
Post-op haze—if present, it portends a higher risk for further regression and/or haze formation. In such cases, the prudent course is to wait at least 6-12 months prior to re-treating.
What factors are associated with the presence of post-op aberrations?

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-?
What factors are associated with the presence of post-op aberrations?
--High degrees of pre-op myopia, hyperopia, or astigmatism
--A smaller ablation zone
--The presence of aberrations pre-op
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Which higher-order aberration is most contributory to pt symptoms?
What factors are associated with the presence of post-op aberrations?
--High degrees of pre-op myopia, hyperopia, or astigmatism
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--The presence of aberrations pre-op

Which higher-order aberration is most contributory to pt symptoms?
Spherical aberration
Photoablaative Surgery Issues

Structural Issues

Five non-visual problems you may encounter post-op
Photoablative Surgery Issues

Structural Issues

Central islands
Decentered ablations
Steroid-induced IOP elevation
Central toxic keratopathy
Infectious keratitis

Five non-visual problems you may encounter post-op
In this context, what is a central island?
In this context, what is a central island?
A small (<1 mm) area of elevation (at least 1D’s worth) within the area of flattening after myopic ablation.
Central island
**Photoablative Surgery Issues**

- Central islands
- Decentered ablations
- Steroid-induced IOP elevation
- Central toxic keratopathy
- Infectious keratitis

**In this context, what is a central island?**
A small (<1 mm) area of elevation (at least 1D’s worth) within the area of flattening after myopic ablation

**In terms of symptoms, how does a central island manifest?**
In this context, what is a central island?
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In terms of symptoms, how does a central island manifest?
As degraded central vision, which may include decreased acuity and monocular diplopia
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Are central islands a common phenomenon?
**Photoablative Surgery Issues**

### Structural Issues

- **Central islands**
- Decentered ablations
- Steroid-induced IOP elevation
- Central toxic keratopathy
- Infectious keratitis

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*Are central islands a common phenomenon?*
Not with current excimer technology, no
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Is the presence of a central island an indication for an immediate surgical revision?
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Is the presence of a central island an indication for an immediate surgical revision?
Many will regress spontaneously, so no
What are common causes of a decentered ablation?
--?
--?
--?
What are common causes of a decentered ablation?
--Loss of fixation by the operative eye
--Poor pre-op head positioning by the surgeon
--Failure to ensure the operative eye is oriented perpendicular to the laser
Decentered ablation
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Is decentration more common with myopic, or hyperopic ablations?
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Hyperopic

Is decentration more visually significant with myopic, or hyperopic ablations?
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Will decentration regress spontaneously like a central island?
No, it must be addressed surgically
What is the main risk factor for steroid-induced IOP elevation?
What is the main risk factor for steroid-induced IOP elevation? 
Use after surgery for a prolonged period of time
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Which class of procedure is at increased risk?
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Use after surgery for a prolonged period of time

Which class of procedure is at increased risk?
Surface ablation procedures
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Why surface procedures?
What is the main risk factor for steroid-induced IOP elevation?
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Why surface procedures?
Because steroids are often used for months afterwards to prevent haze formation
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Why is managing IOP after photoablative surgery especially challenging?
Central islands  Decentered ablations  Steroid-induced IOP elevation  Central toxic keratopathy  Infectious keratitis

What is the main risk factor for steroid-induced IOP elevation?
Use after surgery for a prolonged period of time

Which class of procedure is at increased risk?
Surface ablation procedures

Why surface procedures?
Because steroids are often used for months afterwards to prevent haze formation

Why is managing IOP after photoablative surgery especially challenging?
Because altered corneal thickness and curvature renders applanation tonometry artifactually low. Fluid under a LASIK flap can do the same.
What is the main risk factor for steroid-induced IOP elevation?
Use after surgery for a prolonged period of time

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**Photoablative Surgery Issues**

Central islands

Decentered ablations

**Steroid-induced IOP elevation**

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Infectious keratitis

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Central islands
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Infectious keratitis

What is central toxic keratopathy?
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The development of acute, nonprogressive central corneal opacification in the immediate post-op period.
Central toxic keratopathy
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Is it rare, or common?
What is central toxic keratopathy?
The development of acute, nonprogressive central corneal opacification in the immediate post-op period

Is it rare, or common?
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What is central toxic keratopathy?
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Is it rare, or common? Inflammatory, or noninflammatory?
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Is it rare, or common? Inflammatory, or noninflammatory?
Rare. Noninflammatory.
What is central toxic keratopathy?
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Is it rare, or common? Inflammatory, or noninflammatory?
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What is the cause?
What is central toxic keratopathy?
The development of acute, nonprogressive central corneal opacification in the immediate post-op period

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What is the cause?
It is unknown as of this writing
**Photoablative Surgery Issues**

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**Structural Issues**

- Central islands
- Decentered ablations
- Steroid-induced IOP elevation
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The development of acute, nonprogressive central corneal opacification in the immediate post-op period

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Rare. Noninflammatory.

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It is unknown as of this writing

**In addition to haze formation, what other undesirable effect does it have?**
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It causes flattening of the anterior cornea, thereby producing a hyperopic shift
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How is it treated?
Hypertonic solutions have been proposed, but their efficacy remains unproven
Which is more vulnerable to post-op infection--surface ablation, or LASIK?
Photoablative Surgery Issues

Structural Issues

- Central islands
- Decentered ablations
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Infectious keratitis

Which is more vulnerable to post-op infection—surface ablation, or LASIK?
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Why are surface-based procedures at greater risk for infection?
Which is more vulnerable to post-op infection—surface ablation, or LASIK?
Surface ablation

Why are surface-based procedures at greater risk for infection?
Because the surgical technique involves creating a huge epi defect, thereby stripping the cornea of one of its primary defenses (ie, an intact epithelium)
Which is more vulnerable to post-op infection—surface ablation, or LASIK?
Surface ablation

Why are surface-based procedures at greater risk for infection?
Because the surgical technique involves creating a huge epi defect, thereby stripping the cornea of one of its primary defenses (ie, an intact epithelium). Further, post-op management of surface surgery involves BCLs as well as long-term steroid use, both of which further the risk of bacterial infection.
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Which bugs are most commonly implicated?
Which is more vulnerable to post-op infection—surface ablation, or LASIK?
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Which bugs are most commonly implicated?
Gram+ lid flora: S aureus (including MRSA), Strep pneumoniae and viridans spp. Less commonly, atypical mycobacteria, Nocardia, and various fungal species have been found
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Which bugs are most commonly implicated?
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Are flap-based procedures immune to infection?
Which is more vulnerable to post-op infection—surface ablation, or LASIK?
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Are flap-based procedures immune to infection?
Definitely not. Bugs sequestered under the flap are shielded from the antimicrobial content of the tear film.
Which is more vulnerable to post-op infection—surface ablation, or LASIK?

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Are flap-based procedures immune to infection?
Definitely not. Bugs sequestered under the flap are shielded from the antimicrobial content of the tear film. Treatment requires lifting the flap, scraping it for C&S, and irrigating with abx prior to re-placement.
Infectious keratitis after LASIK
What post-surgical maneuver after surface ablation puts the pt at increased risk for sterile infiltrates?

(Note: There is some degree of overlap between the following questions and those from the previous section)
What post-surgical maneuver after surface ablation puts the pt at increased risk for sterile infiltrates?

The use of a BCL, especially in conjunction with the use of topical NSAIDs without concurrent topical steroids.
What post-surgical maneuver after surface ablation puts the pt at increased risk for sterile infiltrates?

- The use of a BCL, especially in conjunction with the use of topical NSAIDs without concurrent topical steroids.
Post-surface ablation sterile infiltrates
Surface Ablation Issues I: Sterile Infiltrates

- What post-surgical maneuver after surface ablation puts the pt at increased risk for sterile infiltrates?
  - The use of a BCL, especially in conjunction with the use of topical NSAIDs without concurrent topical steroids

- What are the keys to management of sterile infiltrates?
  -
  -
What post-surgical maneuver after surface ablation puts the pt at increased risk for sterile infiltrates?
- The use of a BCL, especially in conjunction with the use of topical NSAIDs without concurrent topical steroids.

What are the keys to management of sterile infiltrates?
- Make sure it’s sterile (ie, that it’s not infectious).
- Add topical steroids and taper topical NSAIDs.
Surface Ablation Issues I: Sterile Infiltrates

- **What post-surgical maneuver after surface ablation puts the pt at increased risk for sterile infiltrates?**
  - The use of a BCL, especially in conjunction with the use of topical NSAIDs without concurrent topical steroids

- **What are the keys to management of sterile infiltrates?**
  - Make sure it’s sterile (ie, that it’s not infectious)
  - Add topical steroids and taper topical NSAIDs
Post-surface-ablation haze can be divided into two categories based on time of onset—what are they?
Post-surface-ablation haze can be divided into two categories based on time of onset—what are they?

- Early onset
- Late onset
Post-surface-ablation haze can be divided into two categories based on time of onset—what are they?

- Early onset.
- Late onset.

For each, how long after surgery until it appears?
Post-surface-ablation haze can be divided into two categories based on time of onset—what are they?

- Early onset. A couple of weeks.
- Late onset. Six to twelve months.

For each, how long after surgery until it appears?
Post-surface-ablation haze can be divided into two categories based on time of onset—what are they?
- Early onset. A couple of weeks.
- Late onset. Six to twelve months.

For each, how long after surgery until it appears?
For each, at what level in the K is the haze located?
Post-surface-ablation haze can be divided into two categories based on time of onset—what are they?

- Late onset. Six to twelve months. Anterior stroma.

For each, how long after surgery until it appears?

For each, at what level in the K is the haze located?
Post-surface-ablation haze can be divided into two categories based on time of onset—what are they?

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For each, how long after surgery until it appears?

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What are the risk factors for development of severe haze?

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Post-surface-ablation haze can be divided into two categories based on time of onset—what are they?
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What are the risk factors for development of severe haze?
- deep vs shallow ablation
- small vs large ablation zone
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- Small ablation zone
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For each, how long after surgery until it appears?

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What are the risk factors for development of severe haze?

- Deep ablation
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How is haze treated?
Post-surface-ablation haze can be divided into two categories based on time of onset—what are they?
- Late onset. Six to twelve months. Anterior stroma.

For each, how long after surgery until it appears?
For each, at what level in the K is the haze located?

What are the risk factors for development of severe haze?
- Deep ablation
- Small ablation zone

How is haze treated?
- Increase steroid use. If this fails…
**Surface Ablation Issues II: Haze**

- **Post-surface-ablation haze can be divided into two categories based on time of onset—what are they?**
  - Late onset. Six to twelve months. Anterior stroma.

- **For each, how long after surgery until it appears?**
- **For each, at what level in the K is the haze located?**
- **What are the risk factors for development of severe haze?**
  - Deep ablation
  - Small ablation zone

- **How is haze treated?**
  - Increase steroid use. If this fails…
  - Debridement in conjunction with topical MMC
Post-surface ablation corneal haze: Pre- and post tx

Figure 1. Slit-lamp microscopy of a cornea before scraping and mitomycin C treatment. The central scar is dense and leads to an irregular and whitish surface.

Figure 2. The same cornea as Figure 1 after scraping and mitomycin C treatment. Six months after the procedure the corneal tissue is clear and no trace of haze is evident.
LASIK Issues I: Cutting The Flap

- **Cutting the flap with a microkeratome...problems**
  - Adequate suction induces an IOP of at least \# mmHg
LASIK Issues I: Cutting The Flap

- **Cutting the flap with a microkeratome…problems**
  - Adequate suction induces an IOP of at least $65\text{ mmHg}$
LASIK Issues I: Cutting The Flap

- Cutting the flap with a microkeratome...problems
  - Adequate suction induces an IOP of at least 65 mmHg
  - Inadequate suction ↑ the risk of a flap prob 1 or flap prob 2
LASIK Issues I: Cutting The Flap

- **Cutting the flap with a microkeratome…problems**
  - Adequate suction induces an IOP of at least 65 mmHg
  - Inadequate suction ↑ the risk of a **thin flap** or **buttonhole**
LASIK flap: Buttonhole
LASIK Issues I: Cutting The Flap

- Cutting the flap with a microkeratome...problems
  - Adequate suction induces an IOP of at least 65 mmHg
  - Inadequate suction ↑ the risk of a thin flap or buttonhole
  - A steep (>46D) cornea ↑ the risk of a thin flap or buttonhole as well
Cutting the flap with a microkeratome...problems

- Adequate suction induces an IOP of at least 65 mmHg
- Inadequate suction ↑ the risk of a thin flap or buttonhole
- A steep (>46D) cornea ↑ the risk of a thin flap or buttonhole as well
LASIK Issues I: Cutting The Flap

- **Cutting the flap with a microkeratome...problems**
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  - A steep (>46D) cornea ↑ the risk of a thin flap or buttonhole as well
  - A flat (<41D) cornea ↑ the risk of a
LASIK Issues I: Cutting The Flap

- **Cutting the flap with a microkeratome…problems**
  - Adequate suction induces an IOP of at least 65 mmHg
  - Inadequate suction ↑ the risk of a thin flap or buttonhole
  - A steep (>46D) cornea ↑ the risk of a thin flap or buttonhole as well
  - A flat (<41D) cornea ↑ the risk of a free cap
LASIK flap: Free cap
**LASIK Issues I: Cutting The Flap**

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  - Inadequate suction ↑ the risk of a thin flap or buttonhole
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  - A flat (<41D) cornea ↑ the risk of a free cap

- **How do you manage a…**
  - Thin flap/buttonhole?
Cutting the flap with a microkeratome…problems

- Adequate suction induces an IOP of at least 65 mmHg
- Inadequate suction ↑ the risk of a thin flap or buttonhole
- A steep (>46D) cornea ↑ the risk of a thin flap or buttonhole as well
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How do you manage a…

- Thin flap/buttonhole? Stop the procedure; re-cut in 3-6 months
LASIK Issues I: Cutting The Flap

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- How do you manage a...
  - Thin flap/buttonhole? Stop the procedure; re-cut in 3-6 months
  - Free cap?
Cutting the flap with a microkeratome…problems

- Adequate suction induces an IOP of at least 65 mmHg.
- Inadequate suction ↑ the risk of a thin flap or buttonhole.
- A steep (>46D) cornea ↑ the risk of a thin flap or buttonhole as well.
- A flat (<41D) cornea ↑ the risk of a free cap.

How do you manage a…

- Thin flap/buttonhole? Stop the procedure; re-cut in 3-6 months.
- Free cap? Place in antidessication chamber; finish the procedure; re-place the cap +/- sutures.
Flap Striae

Two broad category of striae

? ?
LASIK Issues II: Flap Striae and Dislocation

Flap Striae

Two broad category of striae

Macrostriae

Microstriae
LASIK Issues II: Flap Striae and Dislocation

Flap Striae

Two broad categories of striae

Macrostriae

Microstriae
LASIK Issues II: Flap Striae and Dislocation

Flap Striae

Two broad category of striae

Macrostriæe

Microstriæe

What are the two main risk factors for striae?
--?
--?
Flap Striae

Two broad category of striae

- Macrostriae
- Microstriae

**What are the two main risk factors for striae?**

- Thin vs thick flaps
- Deep vs shallow ablations
LASIK Issues II: Flap Striae and Dislocation

Flap Striae

Two broad category of striae

- Macrostriae
- Microstriae

What are the two main risk factors for striae?
- Thin flaps
- Deep ablations
LASIK Issues II: Flap Striae and Dislocation

Flap Striae

- Two broad category of striae
- Macrostriae
- Microstriae

Do all striae require treatment?
LASIK Issues II: Flap Striae and Dislocation

Flap Striae

Two broad category of striae

- Macrostriae
- Microstriae

Do all striae require treatment?
No. If BCVA and subjective VA are good, folds can be observed
LASIK Issues II: Flap Striae and Dislocation

Flap Striae

- Two broad category of striae

Macrostriae

Microstriae

Extent of flap involved
LASIK Issues II: Flap Striae and Dislocation

Flap Striae

- Two broad category of striae
  - Macrostriae
    - Full flap
  - Microstriae
    - Bowman’s layer only
  - Extent of flap involved
LASIK Issues II: Flap Striae and Dislocation

Flap Striae

Two broad category of striae

Macrostriae
Full flap

Extent of flap involved
Clinically significant?

Microstriae
Bowman’s layer only
**LASIK Issues II: Flap Striae and Dislocation**

Flap Striae

Two broad category of striae

- **Macrostriae**
  - Full flap
  - Always

- **Microstriae**
  - Extent of flap involved
  - Clinically significant?
  - Bowman’s layer only
  - Rarely
LASIK Issues II: Flap Striae and Dislocation

Flap Striae

Two broad category of striae

Macrostriae
- Full flap
- Always

Microstriae
- Bowman’s layer only

Extent of flap involved
Clinically significant?
Cause

Always Rarely
Full flap

Clinically significant?

Cause

Always Rarely
LASIK Issues II: Flap Striae and Dislocation

Flap Striae

Two broad category of striae

Macrostriae
- Full flap
- Always
- Flap slippage

Microstriae
- Extent of flap involved
- Clinically significant?
- Cause
- Bowman’s layer only
- Rarely
- Flap contracture
**LASIK Issues II: Flap Striae and Dislocation**

**Flap Striae**

Two broad category of striae

- **Macrostriae**
  - Full flap
  - Always
  - **Flap slippage**

- **Microstriae**
  - Bowman’s layer only
  - Rarely
  - **Flap contracture**

**Extent of flap involved**

**Clinically significant?**

**Cause**

**What is probably the most common cause of flap slippage leading to macrostriae?**
LASIK Issues II: Flap Striae and Dislocation

Flap Striae

Two broad category of striae

Macrostriae
- Full flap
- Always
- Flap slippage

Microstriae
- Bowman’s layer only
- Rarely
- Flap contracture

Extent of flap involved → Clinically significant?

Cause

What is probably the most common cause of flap slippage leading to macrostriae?
Eyelid squeezing by the pt upon removal of the speculum
A pt has multiple macrostriae, all oriented parallel to one another. They stem from the hinge. What is the likely cause?
Flap Striae

Two broad category of striae

Macrostriae
- Full flap
- Always
- Flap slippage

Microstriae
- Bowman’s layer only
- Rarely

Extent of flap involved
Clinically significant?
Cause

A pt has multiple macrostriae, all oriented parallel to one another. They stem from the hinge. What is the likely cause? Frank slippage of the flap. Re-place it immediately!
LASIK flap: Folds from flap slippage
Flap Striae

Two broad category of striae

Macrostriae
- Full flap
- Always
- Flap slippage
  - Cause
  - Extent of flap involved
  - Clinically significant?

Microstriae
- Bowman’s layer only
- Rarely
- Flap contracture

A pt has multiple macrostriae, all oriented parallel to one another. They stem from the hinge. What is the likely cause? Frank slippage of the flap. Re-place it immediately!

Why must slippage be addressed immediately?
A pt has multiple macrostriae, all oriented parallel to one another. They stem from the hinge. What is the likely cause? Frank slippage of the flap. Re-place it immediately!

Why must slippage be addressed immediately? Because if left in place, folds quickly become permanent.
Flap Striae

Two broad category of striae

Macrostriae

Full flap
Always
Flap slippage

Extent of flap involved
Clinically significant?

Microstriae

Bowman’s layer only
Rarely
Flap contracture

A pt has multiple macrostriae, all oriented parallel to one another. They stem from the hinge. What is the likely cause? Frank slippage of the flap. Re-place it immediately!

Why must slippage be addressed immediately?
Because if left in place, folds quickly become permanent

How quickly?
LASIK Issues II: Flap Striae and Dislocation

Flap Striae

Two broad category of striae

Macrostriae

Full flap
Always
Flap slippage

Extent of flap involved
Clinically significant?
Cause

Microstriae
Bowman’s layer only
Rarely
Flap contracture

A pt has multiple macrostriae, all oriented parallel to one another. They stem from the hinge. What is the likely cause? Frank slippage of the flap. Re-place it immediately!

Why must slippage be addressed immediately?
Because if left in place, folds quickly become permanent

How quickly?
Within roughly 24 hours
**LASIK Issues II: Flap Striae and Dislocation**

**Flap Striae**

**Two broad category of striae**

- **Macrostriae**
  - Full flap: Extent of flap involved
  - Always: Clinically significant?
  - Flap slippage: Cause

- **Microstriae**
  - Bowman’s layer only: Rarely
  - Flap contracture: Gutter status
LASIK Issues II: Flap Striae and Dislocation

Flap Striae

Two broad category of striae

Macrostriae
- Full flap
- Always
- Flap slippage
- Widened

Microstriae
- Extent of flap involved
- Clinically significant?
- Cause
- Gutter status
- Bowman’s layer only
- Rarely
- Flap contracture
- Unaffected
**LASIK Issues II: Flap Striae and Dislocation**

**Flap Striae**

- **Macrostriae**
  - Full flap
  - Always
  - Flap slippage
  - **Widened**

- **Microstriae**
  - Bowmar’s layer only
  - Rarely
  - Flap contracture
  - Unaffected

**Why do macrostriae tend to widen the flap gutter?**

- Because the folds reduce the surface area the flap can cover.
LASIK Issues II: Flap Striae and Dislocation

**Flap Striae**

- **Two broad category of striae**
  - **Macrostriae**
    - Full flap
    - Always
    - Flap slippage
    - **Widened**
    - Extent of flap involved
    - Clinically significant?
    - Cause
    - Gutter status
  - **Microstriae**
    - Bowman’s layer only
    - Rarely
    - Flap contracture
    - Unaffected

---

*Why do macrostriae tend to widen the flap gutter?*

*Because the folds reduce the surface area the flap can cover*
# LASIK Issues II: Flap Striae and Dislocation

## Flap Striae

<table>
<thead>
<tr>
<th>Macrostriae</th>
<th>Microstriae</th>
</tr>
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<tbody>
<tr>
<td>Full flap</td>
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<td>Flap contracture</td>
</tr>
<tr>
<td>Widened</td>
<td>Unaffected</td>
</tr>
</tbody>
</table>

- **Extent of flap involved**
- **Clinically significant?**
- **Cause**
- **Gutter status**
- **Acute treatment**

Two broad categories of striae.
LASIK Issues II: Flap Striae and Dislocation

Flap Striae

Two broad category of striae

Macrostriae

Full flap

Always

Flap slippage

Widened

Lift and replace

Extent of flap involved

Clinically significant?

Cause

Gutter status

Acute treatment

Microstriae

Bowman’s layer only

Rarely

Flap contracture

Unaffected

Observation; lubrication
LASIK Issues II: Flap Striae and Dislocation

Flap Striae

Two broad category of striae

Macrostriae

- Full flap
- Always
- Flap slippage
- Widened
- Lift and replace

Macrostriae Extent of flap involved Clinically significant? Cause Gutter status Acute treatment Classic description

Microstriae

- Bowman’s layer only
- Rarely
- Flap contracture
- Unaffected
- Observation; lubrication

Classic description
LASIK Issues II: Flap Striae and Dislocation

Flap Striae

Two broad category of striae

Macrostriae
- Full flap
  - Extent of flap involved
- Always
  - Clinically significant?
- Flap slippage
  - Cause
- Widened
  - Gutter status
- Lift and replace
  - Acute treatment
- ‘Skewed carpet’
  - Classic description

Microstriae
- Bowman’s layer only
  - Rarely
- Flap contracture
  - Unaffected
- Observation; lubrication
  - ‘Cracked mud’
LASIK Issues II: Flap Striae and Dislocation

Flap Striae

Two broad category of striae

Macrostriae
Full flap
Always
Flap slippage
Widened
Lift and replace
'Skewed carpet'

Extent of flap involved
Clinically significant?
Cause
Gutter status
Acute treatment
Classic description

Microstriae
Bowman’s layer only
Rarely
Flap contracture
Unaffected
Observation; lubrication

What clinical maneuver helps bring out the cracked mud appearance?

'Cracked mud'
Flap Striae

Two broad category of striae

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- Full flap
- Always
- Flap slippage
- Widened
- Lift and replace
- ‘Skewed carpet’

Extent of flap involved
Clinically significant?
Cause
Gutter status
Acute treatment
Classic description

Microstriae
- Bowman’s layer only
- Rarely
- Flap contracture
- Unaffected
- Observation; lubrication
- ‘Cracked mud’

---

What clinical maneuver helps bring out the cracked mud appearance?

**Instillation of fluorescein.** The microstriae will be visualized as areas of positive vs negative staining.
Flap Striae

Two broad category of striae

Macrostriae
- Full flap
- Flap slippage
- Widened
- Lift and replace
- ‘Skewed carpet’

Microstriae
- Bowman’s layer only
- Flap contracture

Extent of flap involved
Clinically significant?
Cause
Gutter status
Acute treatment
Classic description

What clinical maneuver helps bring out the cracked mud appearance? Instillation of fluorescein. The microstriae will be visualized as areas of negative staining.
Microstriae: ‘Cracked mud’ appearance after fluorescein instillation
LASIK Issues II: Flap Striae and Dislocation

### Flap Striae

Two broad categories of striae:

**Macrostriae**
- Full flap
- Always
- Flap slippage
- Widened
- Lift and replace
- ‘Skewed carpet’

**Microstriae**
- Bowman’s layer only
- Rarely
- Flap contracture
- Unaffected
- Observation; lubrication
- ‘Cracked mud’

**Visible w/ direct illumination**

**Extent of flap involved**

**Clinically significant?**

**Cause**

**Gutter status**

**Acute treatment**

**Classic description**
LASIK Issues II: Flap Striae and Dislocation

Flap Striae

Two broad category of striae

Macrostriae
- Full flap
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- ‘Skewed carpet’
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Microstriae
- Bowman’s layer only
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- Unaffected
- Observation; lubrication
- ‘Cracked mud’
- No

Extent of flap involved
Clinically significant?
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Classic description
Visible w/ direct illumination
LASIK Issues II: Flap Striae and Dislocation

Flap Striae

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Macrostriae
Full flap
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Widened
Lift and replace
‘Skewed carpet’
Yes

Extent of flap involved
Clinically significant?
Cause
Gutter status
Acute treatment
Classic description
Visible w/ direct illumination

Microstriae
Bowman’s layer only
Rarely
Flap contracture
Unaffected
Observation; lubrication
‘Cracked mud’
No

A pt is found to have circumferential striae. What was likely her pre-op refractive status?
LASIK Issues II: Flap Striae and Dislocation

Flap Striae

Two broad category of striae

Macrostriae

- Full flap
- Always
- Flap slippage
- Widened
- Lift and replace
- ‘Skewed carpet’

Microstriae

- Bowman’s layer only
- Rarely
- Flap contracture
- Unaffected
- Observation; lubrication
- ‘Cracked mud’

Extent of flap involved
Clinically significant?
Cause
Gutter status
Acute treatment
Classic description
Visible w/ direct illumination

A pt is found to have circumferential striae. What was likely her pre-op refractive status?
High myopia
**LASIK Issues II: Flap Striae and Dislocation**

### Flap Striae

Two broad category of striae

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**Extant of flap involved**

**Clinically significant?**

**Cause**

**Gutter status**

**Acute treatment**

**Classic description**

**Visible w/ direct illumination**

---

*Q A pt is found to have **circumferential** striae. What was likely her pre-op refractive status?* High myopia

*Q Are circumferential striae more or less concerning than other types of striae?*
A pt is found to have **circumferential** striae. What was likely her pre-op refractive status?
High myopia

Are **circumferential** striae more or less concerning than other types of striae?
Less. They usually resolve spontaneously.
Flap dislocation

Early

Often occurs on post-op day
Flap dislocation

- Early
  - Often occurs on post-op day 1
• Flap dislocation
  • Early
    • Often occurs on post-op day 1
      ▪ In immediate post-op period, adhesion between flap epithelium and can be stronger than tensile strength of epithelial bridge across flap gutter
Flap dislocation

Early

Often occurs on post-op day 1

- In immediate post-op period, adhesion between flap epithelium and tarsal conj can be stronger than tensile strength of epithelial bridge across flap gutter
LASIK flap: Early post-op dislocation
Flap dislocation

- **Early**
  - Often occurs on post-op day 1
    - In immediate post-op period, adhesion between flap epithelium and **tarsal conj** can be stronger than tensile strength of epithelial bridge across flap gutter

- **Late**
  - Usually secondary to...
Flap dislocation

- Early
  - Often occurs on post-op day 1
    - In immediate post-op period, adhesion between flap epithelium and tarsal conj can be stronger than tensile strength of epithelial bridge across flap gutter

- Late
  - Usually secondary to blunt trauma
Flap dislocation

Early
- Often occurs on post-op day 1
  - In immediate post-op period, adhesion between flap epithelium and tarsal conj can be stronger than tensile strength of epithelial bridge across flap gutter

Late
- Usually secondary to blunt trauma
  - Some healing/scarring occurs at the interface, but essentially none at the rest of the flap/stroma interface
Flap dislocation

Early

- Often occurs on post-op day 1
  - In immediate post-op period, adhesion between flap epithelium and tarsal conj can be stronger than tensile strength of epithelial bridge across flap gutter

Late

- Usually secondary to blunt trauma
  - Some healing/scarring occurs at the edge of the flap, but essentially none at the rest of the flap/stroma interface
Lasik Issues II: Flap Striae and Dislocation

- Flap dislocation
  - Early
    - Often occurs on post-op day 1
      - In immediate post-op period, adhesion between flap epithelium and tarsal conj can be stronger than tensile strength of epithelial bridge across flap gutter
  - Late
    - Usually secondary to blunt trauma
      - Some healing/scarring occurs at the edge of the flap, but essentially none at the rest of the flap/stroma interface
      - Lack of extensive healing means flap is always vulnerable to dislocation from blunt force
Flap dislocation

Early
- Often occurs on post-op day 1
  - In immediate post-op period, adhesion between flap epithelium and tarsal conj can be stronger than tensile strength of epithelial bridge across flap gutter

Late
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Flap dislocation

*Early*
- Often occurs on post-op day 1
  - In immediate post-op period, adhesion between flap epithelium and tarsal conj can be stronger than tensile strength of epithelial bridge across flap gutter

*Late*
- Usually secondary to blunt trauma
  - Some healing/scarring occurs at the edge of the flap, but essentially none at the rest of the flap/stroma interface
  - Lack of extensive healing means flap is always vulnerable to dislocation from blunt force

**Treatment:** Re-place flap ASAP!
Flap dislocation

- **Early**
  - Often occurs on post-op day 1
    - In immediate post-op period, adhesion between flap epithelium and tarsal conj can be stronger than tensile strength of epithelial bridge across flap gutter

- **Late**
  - Usually secondary to blunt trauma
    - Some healing/scarring occurs at the edge of the flap, but essentially none at the rest of the flap/stroma interface
    - Lack of extensive healing means flap is always vulnerable to dislocation from blunt force

- **Treatment:** Re-place flap ASAP!
LASIK flap: Late, traumatic dislocation
LASIK Issues III: DLK

DLK...

...stands for
LASIK Issues III: DLK

- DLK…
  - …stands for *diffuse lamellar keratitis*
LASIK Issues III: DLK

- DLK…
  - …stands for **diffuse lamellar keratitis**
  - aka funny nickname for its grainy appearance
● DLK…
  ● …stands for *diffuse lamellar keratitis*
  ● aka *Sands of Sahara* for its grainy appearance
DLK…

- …stands for *diffuse lamellar keratitis*
- aka *Sands of Sahara* for its grainy appearance
- …is a non-infectious inflammation of the flap-bed interface
DLK…

- stands for *diffuse lamellar keratitis*
- aka *Sands of Sahara* for its grainy appearance
- is a *noninfectious* inflammation of the *flap-bed* interface
LASIK Issues III: DLK

- DLK…
  - …stands for *diffuse lamellar keratitis*
  - aka *Sands of Sahara* for its grainy appearance
  - …is a *noninfectious* inflammation of the *flap-bed* interface
  - …is probably $2^\circ$ to *very general process* of the *important LASIK location*
LASIK Issues III: DLK

- DLK…
  - ...stands for **diffuse lamellar keratitis**
    - aka **Sands of Sahara** for its grainy appearance
  - ...is a **noninfectious** inflammation of the **flap-bed** interface
  - ...is probably 2° to **contamination** of the **interface**
DLK…
- stands for **diffuse lamellar keratitis**
- aka **Sands of Sahara** for its grainy appearance
- is a **noninfectious** inflammation of the **flap-bed** interface
- is probably 2° to **contamination** of the **interface** (with rust, RBCs, bacterial products, etc)

**LASIK Issues III: DLK**
LASIK Issues III: DLK

- DLK…
  - …stands for diffuse lamellar keratitis
  - aka Sands of Sahara for its grainy appearance
  - …is a noninfectious inflammation of the flap-bed interface
  - …is probably 2° to contamination of the interface (with rust, RBCs, bacterial products, etc)
DLK…

- ...stands for **diffuse lamellar keratitis**
  - aka **Sands of Sahara** for its grainy appearance
- ...is a **noninfectious** inflammation of the **flap-bed** interface
- ...is probably 2° to **contamination** of the **interface** (with rust, RBCs, bacterial products, etc)
- ...has 4 grades:
DLK…
- stands for *diffuse lamellar keratitis*
  - aka *Sands of Sahara* for its grainy appearance
- is a *noninfectious* inflammation of the *flap-bed* interface
- is probably 2° to *contamination* of the *interface* (with rust, RBCs, bacterial products, etc)
- has 4 grades:

<table>
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<tr>
<th>Grade</th>
<th>Interface appearance</th>
<th>Effect on vision</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 1</td>
<td></td>
<td></td>
<td></td>
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</table>
**LASIK Issues III: DLK**

- **DLK…**
  - …stands for **diffuse lamellar keratitis**
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<th>Effect on vision</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Granules peripherally</td>
<td>None</td>
<td>Steroid drop q1°</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Dense central granules</td>
<td>Decreased</td>
<td>PF q1° + PO prednisone</td>
</tr>
<tr>
<td>4</td>
<td>Scarring</td>
<td>Decreased</td>
<td>Does not improve</td>
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187
**LASIK Issues III: DLK**

- **DLK…**
  - …stands for *diffuse lamellar keratitis*
  - aka *Sands of Sahara* for its grainy appearance
  - …is a *noninfectious* inflammation of the *flap-bed* interface
  - …is probably 2º to *contamination* of the *interface* (with *rust, RBCs, bacterial products, etc*).
  - …has 4 grades:

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<th>Treatment</th>
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<td>Steroid drop q1º</td>
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<tr>
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<td>None</td>
<td>PF q1º + PO prednisone</td>
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These patients should give you pause before proceeding with ablative keratorefractive surgery:
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- The patient with a POcHx of infection
These patients should give you pause before proceeding with ablative keratorefractive surgery:

- The patient with a POcHx of HSV keratitis
These patients should give you pause before proceeding with ablative keratorefractive surgery:

- The patient with a POCHx of HSV keratitis

*What is the concern re operating on patients with a history of HSV keratitis?*
These patients should give you pause before proceeding with ablative keratorefractive surgery:

- The patient with a POC hx of \textbf{HSV keratitis}

\textit{What is the concern re operating on patients with a history of HSV keratitis?}

Re-activation of the virus
These patients should give you pause before proceeding with ablative keratorefractive surgery:

- The patient with a POchx of **HSV keratitis**
- The patient with a POchx of **abb.**
These patients should give you pause before proceeding with ablative keratorefractive surgery:

- The patient with a POcHx of HSV keratitis
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These patients should give you pause before proceeding with ablative keratorefractive surgery:

- The patient with a POcHx of HSV keratitis
- The patient with a POcHx of DES
- The patient with PMHx of two words
These patients should give you pause before proceeding with ablative keratorefractive surgery:

- The patient with a POcHx of **HSV keratitis**
- The patient with a POcHx of **DES**
- The patient with PMHx of **rheumatoid arthritis**
These patients should give you pause before proceeding with ablative keratorefractive surgery:

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What dreaded post-op complication can occur in RA patients after keratorefractive surgery?
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Wound melt
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What dreaded post-op complication can occur in RA patients after keratorefractive surgery? Wound melt

What ocular condition co-exists with RA, such that the outcome may be suboptimal even in the absence of a wound melt?
These patients should give you pause before proceeding with ablative keratorefractive surgery:

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What dreaded post-op complication can occur in RA patients after keratorefractive surgery? **Wound melt**

What ocular condition co-exists with RA, such that the outcome may be suboptimal even in the absence of a wound melt? **DES**
These patients should give you pause before proceeding with ablative keratorefractive surgery:

- The patient with a POcHx of HSV keratitis
- The patient with a POcHx of DES
- The patient with PMHx of rheumatoid arthritis
- The patient whose pre-op exam suggests the possibility of forme fruste keratoconus or other ectatic disorder
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Of these four conditions, which one is probably most widely regarded as a contraindication to keratorefractive surgery?
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Keratoconus—forme fruste or otherwise

This assertion is technically incorrect. Keratoconus is certainly a contraindication for RK as well as keratoablative procedures such as LASIK and PRK. However, there is a keratorefractive procedure that is not only not contraindicated in keratoconus, it is used to treat keratoconus. What is it?

Corneal inlay (ie, Intacs) procedure

No question—proceed when ready
These patients should give you pause before proceeding with ablative keratorefractive surgery:

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Keratoconus—forme fruste or otherwise

Even this is not universal—there are good and honorable surgeons who will perform keratoablative refractive surgery on forme fruste patients.
In this context, what does ectasia refer to?
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Ectatic disorders include:

- three words
- one word
- different three words
- abb.
In this context, what does ectasia refer to? A noninflammatory, progressive disorder of corneal biomechanics which leads to thinning and warping.

Ectatic disorders include pellucid marginal degeneration, keratoglobus, Terrien marginal degeneration, KCN.
KCN Keratoglobus

Pellucid marginal degeneration

Keratoglobus

Terrien marginal degeneration
In this context, what does ectasia refer to? A noninflammatory, progressive disorder of corneal biomechanics which leads to thinning and warping.

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Is post-surgery ectasia more common after LASIK, or surface procedures?
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- Is post-surgery ectasia more common after LASIK, or surface procedures? LASIK, by a mile.
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Is post-surgery ectasia more common after LASIK, or surface procedures? LASIK, by a mile.

While there are many risk factors, two dwarf the others in importance. What are they?

- A too-thin residual stromal bed (RSB)
- A cornea predisposed to ectasia (ie, biomechanically abnormal)
In this context, what does ectasia refer to? A noninflammatory, progressive disorder of corneal biomechanics which leads to thinning and warping.

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While there are many risk factors, two dwarf the others in importance. What are they?
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What is the tx? RGPs; CXL +/- ICRS; PK