American Society of Cataract and Refractive Surgery

25-29 April, 2014
Boston, Massachusetts
Boston Convention Center

Course 28-409 BCEC
Room 258 C

“Refractive and Cataract Surgery Nightmares: Management and Prevention of Premium IOLs and Laser Vision Correction Complications”

Senior Instructor:
Donald N Serafano, MD

Instructor:
Eric Donnenfeld, MD
Mounir Khalifa, MD
Richard L. Lindstrom, MD
Marguerite B. McDonald, MD
Matteo Piovella, MD
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Roberto Zaldivar, MD

Monday, April 28, 2014
3.00 PM – 4.30 PM
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Matteo Piovella MD

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Matteo Piovella MD

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Matteo Piovella MD

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Matteo Piovella MD

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Matteo Piovella MD

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“Introduction 1990: History Of Multiple Optical Zone And Prk Nightmares”

Matteo Piovella MD

Nightmares: experience, situation or object producing a feeling of anxiety (Webster’s)

**High myopia patient: a portrait**
- Personality influenced from myopia
- Living high myopia as an handicap
- With profound desire to reduce myopia

**How do they perceive Laser treatment?**
- Laser preventing evolution of myopia
- Laser preventing complications typical of high myopia

**Education**
- Knowledge of possible complications
- Discuss about the future: presbyopia

Patients with high myopia just want....to be less myopic

*Laser Refractive Surgery: what happens in years?*

**Originally designed technique (1990)**

**Criteria**
- Increased optical zone diameter
- Multiple optical zones (4.0, 5.0, 6.0 mm)
- Steps of similar height

**Large optical zone (1990) Limits**
- Homogeneous laser beam
- Adequate laser power
- Accurate control of laser parameters and efficiency

**Technique**
- Step height: less than 43 microns
- Maximal difference between steps: 8 micron
- Maximal total ablation: 121 microns

**1990 – 1994**
- 56 eyes
- 44 patients (26 men, 18 women)
- age: 32 ± 8 y.o.
- follow up*: 26 ± 14 mos.
  *= (mean ± S.D.)

**Inclusion Criteria**
- age > 20 y.o.
- contact lens intolerance
- corneal pachimetry > 450 micron
- myopia > 5.50 D

**Preoperative refraction**
- -11.3 ± 4.5 D (mean SE ± S.D.)
- range: -5.75 to -24.50 D

**Aimed myopia reduction**
- -9.44 ± 3.2 (mean SE ± S.D.)
**Final Refraction (with retreatments): 56 eyes**

Achieved 95.2% of attempted correction

**Patient Satisfaction**
- questionnaire
- 31 patients, 41 eyes
- satisfaction evaluated for each single eye
  
  32.1 ± 10.9 months after surgery

**Glare - Halos - Night Vision Impairment**

single zone: glare in 43.0% of cases after 1 yr. 
*(Seiler T - Ophthalmology 1994; 101)*

Two zones: night vision impairment in 70% of cases at 6 months
*(Kim JH – Refract Corn Surg 1993; 9 (suppl.))*

night vision impairment is reduced with a wide optical zone

**Patient Satisfaction**
- Halos  51.2 %
- Night driving problems 47.4 %

**Patient Satisfaction**
- Decrease of symptoms with time 73.2 %
- Pleased with results 92.7 %

**What’s behind the Corner ?**

Some eyes show haze, regression, scarring...

**What’s behind the Corner ?**

Are they just like successfully treated eyes ?

**Extraocular Factors Probably Influencing the Results of PRK**

*Giovanni Fumagalli, M.D.*
*(Bergamo - Italy)*

**PRK : 463 eyes**

8% (n=37) of eyes with 8 or > D showed:

important regression + haze + scarring

**Extraocular Factors Probably Influencing the Results of PRK**

Highly myopic patients represent a difficult problem

**PRK : 463 eyes**

Excimer PRK for moderate and severe myopia allows consistent, stable and satisfactory (even if not perfect) results on a long-term basis.
“Doc, I Want Both Eyes Done At The Same Time”
Matteo Piovella MD

The decision belongs to the Ophthalmologists...
But if treatment should be bilateral the Patient must thoroughly share the choice

Bilateral Treatment? Bilateral Complication!!

<table>
<thead>
<tr>
<th><strong>Bilateral Complication</strong></th>
<th><strong>Bilateral Complication</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dramatic if...</td>
<td>Unilateral complication:</td>
</tr>
<tr>
<td>- Diffuse interlamellar keratitis (SOS)</td>
<td><strong>Unhappy patient</strong></td>
</tr>
<tr>
<td>- Epithelialization</td>
<td>Bilateral complication:</td>
</tr>
<tr>
<td>- Haze</td>
<td><strong>Very unhappy, very aggressive patient</strong></td>
</tr>
<tr>
<td>- Unpredictable postoperative reaction (i.e. steroid reponder)</td>
<td></td>
</tr>
<tr>
<td>- Important regression</td>
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</table>

<table>
<thead>
<tr>
<th><strong>Bilateral Complication</strong></th>
<th><strong>Bilateral Complication</strong></th>
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</thead>
<tbody>
<tr>
<td>When to avoid bilateral surgery</td>
<td>Unilateral Vision Severe Loss:</td>
</tr>
<tr>
<td>- Limited experience with a technique</td>
<td><strong>30% disability</strong></td>
</tr>
<tr>
<td>- During a period of technical evolution</td>
<td>Bilateral Vision Severe Loss:</td>
</tr>
<tr>
<td>- With psychologically delicate patient</td>
<td><strong>100% disability</strong></td>
</tr>
<tr>
<td>- Very demanding patient</td>
<td></td>
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</tbody>
</table>

*Avoid to talk the patient into bilateral surgery*

<table>
<thead>
<tr>
<th><strong>Bilateral Treatment</strong></th>
<th><strong>Bilateral Treatment</strong></th>
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</thead>
<tbody>
<tr>
<td>Means:</td>
<td>Patients with a complication in one eye...</td>
</tr>
<tr>
<td>Losing the time interval that one treated eye may need for stabilization</td>
<td>Wait a <em>ooong</em> time before having surgery on the fellow eye</td>
</tr>
</tbody>
</table>
Against all odds…
I have treated both eyes on a patient. And he has a complication.

And now WHAT?

<table>
<thead>
<tr>
<th>For the Ophthalmologists:</th>
<th>For the Patient:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Do not look for improptu solutions</td>
<td>• Target: do not lose the patient</td>
</tr>
<tr>
<td>• Group therapy: ask for suggestion to a</td>
<td>• Dedicated time</td>
</tr>
<tr>
<td>colleague with more experience</td>
<td>• Customized management</td>
</tr>
<tr>
<td>• Exchange opinions (to decrease anxiety)</td>
<td>• Do not live control examination time as a nightmare</td>
</tr>
<tr>
<td>• Look for colleagues with experience in the</td>
<td>• He/she is a patient that needs help</td>
</tr>
<tr>
<td>problem</td>
<td></td>
</tr>
</tbody>
</table>

Unilateral Treatment

Information on postoperative behaviour of first eye (haze, regression, patient satisfaction, halos)

is always determinant for treatment strategy in the second eye

Helping our Patients is Helping Ourselves

If you feel you cannot manage the case, do not hesitate to refer to a more experienced Ophthalmologist

“I Wish Would Have Never Treated This Patient… Treating The Wrong Patient”

Matteo Piovella MD

<table>
<thead>
<tr>
<th>Refractive defect: is a disease?</th>
<th>Myopia is less perceived as a disease</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Then, i.e., cataract</td>
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</tbody>
</table>

Patients often unconsciously deny refractive surgery is real surgery

<table>
<thead>
<tr>
<th>Avoid:</th>
<th>Defence Line</th>
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<tbody>
<tr>
<td>• Depressed patients</td>
<td>• Accurate patient selection</td>
</tr>
<tr>
<td>• Patients assuming psyco-drugs</td>
<td>• Golden number of excluded patients:</td>
</tr>
<tr>
<td>• Patients that do not listen</td>
<td>20%-40%</td>
</tr>
<tr>
<td>• Patients that have a “magic attitude towards</td>
<td>• Do not treat them</td>
</tr>
<tr>
<td>refractive surgery</td>
<td>• Standardized Informed Consent</td>
</tr>
<tr>
<td></td>
<td>Question-and-answer Informed Consent</td>
</tr>
</tbody>
</table>
### “Irregular Astigmatism After Rk: Retreatment With Tosca Customized Ablation”

**Matteo Piovella MD**

<table>
<thead>
<tr>
<th><strong>Excimer Ablation on RK eyes</strong></th>
<th><strong>Materials and Methods</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Considered very dangerous by many surgeons due to central corneal haze originating from RK incisions</td>
<td></td>
</tr>
<tr>
<td>- In our opinion this is true for deep ablations. Customized ablations regularize corneal surface and require little tissue removal</td>
<td></td>
</tr>
<tr>
<td>- 20 RK eyes</td>
<td></td>
</tr>
<tr>
<td>- Follow-up: 3 to 16 yrs (mean 9.33 yrs)</td>
<td></td>
</tr>
<tr>
<td>- Customized ablation with TOSCA link and Meditec MEL 70 Excimer Laser</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>TOSCA Ablation after RK (20 cases)</strong></th>
<th><strong>Conclusions</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- BCVA pre-op (mean): 0.48</td>
<td></td>
</tr>
<tr>
<td>- BCVA post-op (mean): 0.69</td>
<td></td>
</tr>
<tr>
<td>- SE pre-op (mean): -0.63 D</td>
<td></td>
</tr>
<tr>
<td>- SE post-op (mean): -0.27 D</td>
<td></td>
</tr>
<tr>
<td>- Ast. Pre-op (mean): 2.8 D</td>
<td></td>
</tr>
<tr>
<td>- Ast. Post-op (mean): 1.5 D</td>
<td></td>
</tr>
<tr>
<td>- Results in these difficult cases have been fairly good</td>
<td></td>
</tr>
<tr>
<td>- Postoperative haze ranged from 0 to 1 and disappeared within 2-3 months</td>
<td></td>
</tr>
<tr>
<td>- In some cases we adopted a cautious approach, limiting the amount of ablation</td>
<td></td>
</tr>
<tr>
<td>- Probably the new MEL 80 will give us even better results</td>
<td></td>
</tr>
</tbody>
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### “Lasik Complications: Sands Of The Sahara”

**Matteo Piovella MD**

<table>
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<tr>
<th><strong>PRK</strong></th>
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<td><strong>Glare – Halos – Night Vision Impairment</strong></td>
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<tr>
<td>- Single zone: glare in 43% of cases after 1 yr <em>(Seller T – Ophthalmology 1994; 101)</em></td>
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<td>- Two zones: night vision impairment in 70% of cases at 6 months <em>(Kim JH – Refract Corn Surg 1993; 9 (suppl)) night vision impairment is reduced with a wide optical zone</em></td>
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</tr>
<tr>
<td><strong>Patient satisfaction (personal experience)</strong></td>
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<tr>
<td>- Decrease of symptoms with time: 73.2%</td>
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<tr>
<td>- Pleased with results: 92.7%</td>
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Nightmare: experience, situation or object producing a feeling of anxiety (Webster’s)
**LASIK just like topical anesthesia**
- More liked by the patient
- More intraoperative problems

**LASIK just like topical anesthesia**
- Reduction of postoperative pain
- Visual function immediately restored

**First cases**
- 107 eyes
- 60 patients
- Preoperative refraction: -6.7 D ± 3.9 D

**Intra-operative complications**
- Inclusions: n=4
- Flap striae: n=4

**Intraoperative complications**
- Surgeon’s vision at the microscope is coaxial
- Slit lamp examination before discharge is mandatory: the only way to visualize inclusions

**Inclusions: prevention**
- Correct surgical field preparation
- Eyelid draping
- Powder-free gloves
- Lint-free drapes (no tissues)
- Repeated, Niagara washing
- Complete conjunctival rinsing
- No haircut the day before

**Inclusions: management**
Evaluation criteria:
- Size
- Flap malpositioning
Removal is suggested, however:
- If small: may leave
- If big: remove them

**Microkeratome-related complications**
- Free cap: n=0
- Incomplete flap: n=0
- Irregular flap: n=0

**Microkeratome-related complications: Prevention**
- Accurate control of suction system
- Safety system check
- Accurate cleaning of the motor-side surface (Sahara’a sands)
- Wetting suction ring

**Microkeratome-related complications: Microkeratome testing**
- Engagement with suction ring
- Speed
- Back and reverse motion
- Motion smoothness
- Correct stop
- Down-up technique
- Single-piece microkeratomes
- Wetting suction ring
**Microkeratome-related complications:**

**Management**
- Correct corneal marking repositioning

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**Sands of Sahara: Term introduced by Kerry Assil, California**

**Synonyms:**
- Diffuse Interlamellar Keratitis
- Diffuse Lamellar Keratitis
- Interface Keratitis
- Diffuse Interface Keratitis
- Non-specific Diffuse Interface Keratitis

---

### Onset
- 2-5 days postoperatively
- If bilateral surgery, often 1st eye affected

### Characteristics
- Confined to interface
- Diffused and scattered through a large area
- Multiple faint foci
- Infiltrates more concentrated around surgical debris
- Little/anterior chamber reaction
- No overlying epithelial defect *(Smith & Maloney, Ophthalmology, 1998; 105:1721-1726)*

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### Etiology
- **Unknown**
- Allergic or toxic reaction

### Etiology
- Chemotactic factors
- Leukocytes from limbal vasculature attraction from chemotactic factors
**Etiology Multifactorial**
- Epithelial toxicity
- Flap epithelial abrasion
- Endogenous material: meibomian secretions, red blood cells, epithelium
- Exogenous toxins: talc, oil, instrument milk, NSAID, microkeratome blades
- Bacterial exotoxin/endotoxin of SoS: bacterial exotoxins/endotoxin

*(Doane JF,)*

**Etiology Multifactorial**
- Oil
- Wax
- Metallic fragments
- Silicates
- Betadine
- Bacterial endotoxins
- Epithelial defects
- NSAID drops
- Laser/contamination interaction
- Others

*(Lindstrom RL)*

**Sands of Sahara : theory**
- After several procedures on the same day
- Fluid percolation from engine down to blade
- Blade heats stromal bed
- Chemical reaction
- Aseptic necrosis

**Sands of Sahara**
*No known pathology*

**Incidence:**
- 1:200 - 1:1000 occurrence in clusters

**Sands of the Sahara Diagnosis**
- Dusting of creamy colored leukocytes
- In the interface
- Initially peripheral
- Later diffuse

**Sands of the Sahara Differential Diagnosis**
- Infectious keratitis
  - Epithelial ingrowth (no pain)

**Sands of the Sahara Diagnostic Strategy**
- Identifying cells in lamellar surface
- Staging their location and severity
- Intervening at appropriate time

*(Lindstrom RL)*

**Staging (Lindstrom)**
- **Stage 1:** white, granular cells in periphery
- **Stage 2:** white, granular cells in center of flap
- **Stage 3:** dense, white, clumped cells in central visual axis
- **Stage 4:** stromal melting, permanent scarring, visual morbidity
**Classifications (Machat)**
- **Grade 1**: mild – vision unaffected
- **Grade 2**: like moderate PRK haze – BCVA reduced
- **Grade 3**: dense central infiltrate – decreased BCVA several lines

**Classifications (Hatsis)**
- **Grade I.**: partial interface, no topographic change, excellent vision
- **Grade II.**: complete interface, topographic changes, vision still excellent
- **Grade III.**: + foggy vision
- **Grade IV.**: + injection, lid edema, a/c cells

---

**Sands Of The Sahara: Personal Experience**

**8 eyes – 5 patients**
- All first treatments
- Mean patient age: 28.5 ± 8.6 yrs.
- BCVA: 20/21.2 ± 2.3
- Correction (SE): -5.3 ± 3.8 sph

**8 eyes – 5 patients**
- Onset: 2.6 ± 2.0 days after surgery
- BCVA: 20/37.5 ± 10.0

---

**Treatment:**
- Dexamethasone-heparin eyedrops
- Lomefloxacin eyedrops
- For a mean of 27.8 ± 4.0 days

**Follow-up:**
- 248 ± 137 days
- BCVA 20/23.1 ± 3.7
- SE +0.3 ±1.3 sph

---

**Case history: a retreatment**
- 41 y.o man
- BCVA preop 20/30 –11.00 –3.00 (10)
- Surgery: 10/07/98
- BCVA postop: 20/30 +4.00 –2.50 (85)

**Case history: a retreatment**
- On 03/16/2000:
  - 1st day postop: BCVA 20/30 no correction

---

**Case history: 6 days postop**
- BCVA 20/63
- Put on standard treatment

**Case history: 2 months postop**
- BCVA 20/40 –0.50 sph
Sands of the Sahara

Management
- Topical steroid (desamethasone ointment)
- Topical antibiotic (fluoroquinolone)
  strict follow up

Prevention
- Accurate cleaning of microkeratome
- ?

Conclusions

New microkeratomes reduce complications, anyway LASIK remains...

a territory to be explored!

LASIK patients need to be strictly monitored in the postoperative period.

“A New Solid State Uv Laser For Refractive Surgery”
Matteo Piovella MD

This device is not FDA approved

LASER SOFT (Katana Technologies GmbH, Germany)

- Laser radiation wavelength: 210 nm
- Cw-diode-pumped all-solid-state UV Laser
- Very stable shot-to-shot
- High long-term UV output stability

- Excellent UV light spot distribution on the cornea
- Accurate overlap of true gaussian spot
- Extremely homogeneous corneal surface
- Flying spot of 0.25 mm in diameter
- Operating at repetition rate of 1 kHz

Lasersoft and custom ablation
It’s very small spot size fits the present requirements for effective custom ablation

Ablation algorithm
- Adopted ablation profiles designed to preserve the strongly aspherical feature of normal cornea
- This to minimize induced spherical aberration
- Different reflection losses and fluence values for different angles of incidence of the ablating laser radiation are taken into account
Solid-state UV Laser
Applying less energy to the cornea, this solid-state UV laser appears as a promising solution for a refractive surgery, thus with the potential of inducing less scarring due to a more homogeneous treatment.

- Less surgical performance variability
- No gas exchange/discharge
- No instabilities in the output radiation due to the discharge process
- Solid-state UV Laser approach and diode pumping system features long lifetime and efficiency
- Reduced maintenance requirements and related costs

- Eye-tracker with a 1 ms latency
- Monitoring the ablation centration at very high repetition rates
- Reliable, high repetition rate centration of ablation
- On the x-y axes as well as the ocular rotation

- High repetition rate (1 KhZ)
- Lower energy per pulse than in standard excimer treatments
- Ablation with strongly reduced stress waves
- No audible sound due to ablation or laser firing
- Treatment in a silent, patient-reassuring environment
- No sudden patient movement as laser starts

Preliminary clinical data
- 22 eyes of 19 patients
- age (mean ± SD): 38 ± 13 yrs
- 12 PRK, 10 LASIK

Preliminary clinical data - Preoperative
- SE refractive defect: -2.53 ± 3.21 D
- Sphere: -2.32 ± 2.90 D
- Cylinder: -0.43 ± 1.33 D

Preliminary clinical data - Postoperative
- SE refractive defect: -0.27 ± 0.36 D
- Sphere: -0.24 ± 0.30 D
- Cylinder: -0.06 ± 0.41 D

SE refractive defect, attempted vs. obtained:
-0.27 D ± 0.36 D

Preliminary clinical data - Preoperative
- SE refractive defect: -2.53 ± 3.21 D
- Sphere: -2.32 ± 2.90 D
- Cylinder: -0.43 ± 1.33 D

Preliminary clinical data - Postoperative
- SE refractive defect: -0.27 ± 0.36 D
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Preliminary clinical data - Postoperative
- SE refractive defect: \(-0.27 \pm 0.36\) D
- Sphere: \(-0.24 \pm 0.30\) D
- Cylinder: \(-0.06 \pm 0.41\) D

SE refractive defect, attempted vs. obtained:
\(-0.27\) D \(\pm\) 0.36 D

Solid-state UV Laser - Safety
BSCVA pre-operative: 0.80 \(\pm\) 0.23
BSCVA post-operative: 0.83 \(\pm\) 0.23

Conclusions
A safe, reliable, stable, more compact and less costly alternative to gas-operating excimer lasers for refractive surgery

“Wavefront – Guided Ablation after Spherical Phakic IOL to Correct Astigmatism”
* Mounir Khalifa MD PhD

Wavefront-guided ablation has many advantages:
- Wavefront measurements are 25 times more precise than a manifest refraction
- Objective measurement of the patient’s entire optical system
- Help reduce or maintain higher order aberrations
- Iris Registration and pupil centroid shift (Star 5xIR) which ensures accurate axial and torsional registration.
- We did a study to evaluate the efficiency of wavefront-guided PRK after posterior chamber phakic IOL (spherical ICL: STAAR) to correct moderate to high myopia with astigmatism in cases beyond limits of LVC alone.
- Spherical ICL was implanted to correct spherical myopia. ICL power was chosen to leave eye with spherical error -0.5 to -1.0 D.
- 1-6 months later, wavefront-guided PRK was done to correct the remaining refractive error using Visx Star S4 with IR.

- Preoperative UCVA, BCVA, MR, contrast sensitivity.
- Pentacam was used for K readings, ACD, white to white corneal diameter.
- UCVA, BCVA, MR, contrast sensitivity, and HOAs were measured after ICL implantation and after WF-guided PRK.

Means of sphere and cylinder at different stages.

Safety of ICL=1.6
Safety of WF=1.0

Contrast Sensitivity showed significant improvement post ICL and no significant change post WF.

Comparison of PSF PostICL and postWF.
Comparison of ocular HOA's post ICL and post WF showed no significant change.

Corneal HOA's showed no significant change after WF-guided ablation.

Post ICL corneal HOA's | Post WF corneal HOA's

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**Conclusion**

- Spherical posterior chamber phakic IOL (ICL) combined with wavefront-guided excimer laser ablation (BIOPIC) is a safe and effective combination to correct moderate to high myopia with significant astigmatism in cases beyond limits of LVC.
- This technique significantly improved CS in the cases used to have their CS reduced after LVC to correct high myopia.
- There was no significant change either in ocular or corneal HOA's.

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THANK YOU
Diffuse lamellar keratitis (DLK) is also known as "Sands of Sahara Syndrome". It is a well known, though poorly understood complication of LASIK. Diffuse lamellar keratitis appears an undulating pattern of white blood cells at the interface, usually appearing during the first 24 to 48 hours. DLK appears to have several different possible causes: bacterial endotoxins left behind in the autoclave if the reservoir has not been drained after the day's cases are finished; meibomiam gland secretions; foreign bodies from the microkeratome or the drape material; cytokines from crushed epithelial cells; the presence of epithelial defects on the flap; and possibly epithelial ingrowth. There are other possible causes which have been debated by the experts, but these are considered to be the most likely causes.

It is important to stage DLK, as this dictates how it is treated.

* **Stage One** is a peripheral infiltration of white blood cells in a very fine and diffuse pattern; they have not yet layered into the undulating pattern (the classic "Sands of Sahara" picture). The visual axis is not yet affected in Stage One, and the DLK may even occur in only one small patch or in one quadrant. The treatment for Stage One is very heavy topical steroids (Prednisolone acetate or Decadron every hour while awake) with followup at 24 hours.

* **Stage Two** is very similar to Stage One except that the central cornea is involved. The treatment is the same as in the Stage One, with followup at 24 hours and daily until the DLK begins to resolve.

* **Stage Three** is characterized by a denser infiltration in the classic "Sands of Sahara" pattern. Visual Acuity is reduced and the patient may complain of a general haze to his/her vision. The treatment is immediate rinsing of the interface with sterile BSS, followed by topical Prednisolone acetate or Decadron drops every hour while awake. The patient should be seen on a daily basis to insure that the DLK is resolving.

* **Stage Four** is characterized by extremely heavy infiltration and scarring at the interface, with a marked loss of vision. Although rinsing is advisable if the patient is diagnosed within the first seven to ten days. Usually there is residual haze and irregular astigmatism which will result. Often, there is a marked hyperopic shift as well, as stromal tissue has been destroyed by collagen masses. These patients may require a heavily tinted rigid gas permeable contact to see without glare, and may actually require a penetrating keratoplasty if the loss vision is severe enough. Some patients may be treated at a later date with a customized ablation.

In Stages Three and Four oral steroids may sometimes be used if it appears that the DLK is returning after the rinsing procedure, and in spite of heavy topical steroids. Usually 80 mg of Prednisone taking daily for five to seven days with a rapid taper (accompanied by Zantac 150 mg po bid) will ensure that the DLK does not return.
LASIK 26 yo FEMALE

- -2.00 sphere OU
- Uncomplicated LASIK
- Day 1 - Stage 1 DLK
- PF q 1h WA, FML ointment at hs

One month postop
26 yo female

- UCVA 20/20 OU
- No residual scar or irregular astigmatism

LASIK

52 years old Male

- -6.25 *1.50 x 90 OU
- LASIK without complication
- Day 1 – VA sc 20/25 OU
  Stage 1 DLK OU began PF q 1 hr WA
- Day 5 – va sc 20/25 OD, 20/20 OS
  Stae 4 dlk OD- began oral Prednisone 60 mg/day
**CLINICAL PRESENTATION**
- Appears on first day postoperatively
- White or tan cellular infiltrate typically aligned in rows or waves in interface
- Begins in flap periphery and moves centrally
- In bilateral simultaneous surgery, tens affect eye treated first most severely or exclusively (but not universal)

**STAGING**
GRADE 1 Granular cells in periphery of flap sparing visual axis
GRADE 2 Granular cells in central area of flap involving visual axis
GRADE 3 Aggregation of cells in center with clumping: may clear peripherally
GRADE 4 Corrugated "mud crack2 appearance with stromal melting

**MANAGEMENT**
**DLK**
- Topical steroids for stage 1 and 2
- Interface irrigation for stage 3
- Prevent stage 4
- Typically will prevent visual morbidity

**MANAGEMENT: TREATMENT**
STAGE 1-2 Frequent topical steroids (e.g. Pred Forte q 1h, FML ung qhs)
TENDS TO PEAK DAY 2-4, THEN SLOWLY CLEAR
STAGE 3 lift flap, irrigate, wipe with moist Merocel, do not scrape, continue frequent topical steroids

**PREVENTION**
**DLK**
- Keep microkeratome motor clean
- Clean/irrigate blades
- Talc free gloves
- Irrigation of interface
- Nightly siphoning and drying of sterilizer

**SUMMARY**
**DLK after LASIK**
- Be aware of potential complications
- Early identification of DLK is key
  - If unsure, see on day 3
  - Irrigate on day 3 or 4
“Epithelial Defects Related To Lasik”
Donald N Serafano MD

<table>
<thead>
<tr>
<th>Preoperative evaluation</th>
<th>Preoperative evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Dry eye syndrome</td>
<td>• Blepharitis</td>
</tr>
<tr>
<td>• Keratoconjunctivitis sicca</td>
<td>• Recurrent erosions</td>
</tr>
<tr>
<td>• Contact lens failure</td>
<td>• Previous corneal surgery or trauma</td>
</tr>
<tr>
<td>• Poor eyelid closure</td>
<td>• Contact lens wear</td>
</tr>
<tr>
<td>• Meibomian gland dysfunction</td>
<td>• Map dot corneal dystrophy</td>
</tr>
<tr>
<td>• Collagen-vascular disease</td>
<td>• Known anterior basement membrane disease</td>
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</table>

<table>
<thead>
<tr>
<th>Preoperative treatment</th>
<th>Surgical considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Discontinue contact lenses</td>
<td>• Topical anesthetic immediately preoperative</td>
</tr>
<tr>
<td>• Artificial tears</td>
<td>• “push” test</td>
</tr>
<tr>
<td>• Lubricating ointments</td>
<td>• Lubrication of cornea prior to microkeratome placement</td>
</tr>
<tr>
<td>• Punctal plugs</td>
<td>• Change to PRK</td>
</tr>
<tr>
<td>• Treat meibomian gland dysfunction and blepharitis</td>
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</table>

<table>
<thead>
<tr>
<th>Postoperative treatment</th>
<th>Postoperative considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Bandage contact lens</td>
<td>• Increased risk of epithelial ingrowth</td>
</tr>
<tr>
<td>• Pressure patch</td>
<td>• Increased risk of DLK</td>
</tr>
<tr>
<td>• Artificial tears</td>
<td>• Prolonged recovery</td>
</tr>
<tr>
<td>• NSAIDS</td>
<td>• Delay of fellow eye surgery</td>
</tr>
<tr>
<td>• Many postoperative visits</td>
<td>• Punctal plugs or punctual occlusions</td>
</tr>
</tbody>
</table>
"Microkeratome Problems And Solutions"
Donald N Serafano MD

**MICROTECH**
**LSK ONE NOMOGRAM**
*Courtesy of Dr. Michael Belin M.D., Albany NY*

**Vacuum Ring And Stop Ring Selection**
**Selection based on HORIZONTAL K reading**

<table>
<thead>
<tr>
<th>Desired OZ</th>
<th>K&lt;=39</th>
<th>39&lt;K&lt;=41</th>
<th>41&lt;K&lt;=43</th>
<th>43&lt;K&lt;=46</th>
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<tbody>
<tr>
<td>8.0mm</td>
<td>-1/7.0</td>
<td>0/7.0</td>
<td>+1/7.0</td>
<td>+2/7.0</td>
<td>N/A</td>
</tr>
<tr>
<td>8.5mm</td>
<td>0/7.0</td>
<td>+1/7.0</td>
<td>+2/7.0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>9.0mm</td>
<td>-1/7.5</td>
<td>0/7.5</td>
<td>+1/7.5</td>
<td>+2/7.5</td>
<td>+1/7.5</td>
</tr>
<tr>
<td>9.5mm</td>
<td>H/8.0</td>
<td>-1/8.0</td>
<td>0/8.0</td>
<td>0/8.0</td>
<td>N/A</td>
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<tr>
<td>10.0mm</td>
<td>H/8.5</td>
<td>-1/8.5</td>
<td>0/8.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.5mm</td>
<td>H/9.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CARRIAZO-BARRAQUER NOMOGRAM**
*Courtesy of Dr. Cezar Carriazo M.D., Colombia*

**Vacuum Ring Selection**
**Selection based on K reading in the AXIS of where your HINGE is placed**

<table>
<thead>
<tr>
<th>Desired OZ</th>
<th>K&lt;=39</th>
<th>39&lt;K&lt;=41</th>
<th>41&lt;K&lt;=43</th>
<th>43&lt;K&lt;=46</th>
<th>46&lt;K</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.0mm</td>
<td>0</td>
<td>+1</td>
<td>+2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.5mm</td>
<td>-1</td>
<td>0</td>
<td>+1</td>
<td>+2</td>
<td></td>
</tr>
<tr>
<td>9.0mm</td>
<td>-1</td>
<td>0</td>
<td>+1</td>
<td>+2</td>
<td></td>
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<tr>
<td>9.5mm</td>
<td>H</td>
<td>-1</td>
<td>0</td>
<td>+1</td>
<td></td>
</tr>
<tr>
<td>10.0mm</td>
<td>H</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>10.5mm</td>
<td>H</td>
<td></td>
<td></td>
<td></td>
<td>-1</td>
</tr>
</tbody>
</table>

(Suggested Combinations only-individual patient selection may vary)

H ring must be used with caution-verify OZ with applanation lens. Be aware of the large flap diameters created with the H ring.
“Methicillin-Resistant Ocular Infection”
Donald N Serafano MD

The Threat of MRSA
- 1950 1-2% of all infections were MRSA
- 2000 50 % of all infections are MRSA
- Resistance is to Methicillin and other beta-lactamase antibiotics, with increasing resistance to fluoroquinolones

Visual Implications of MRSA
- MRSA infections often result in tissue necrosis and sloughing of the epithelium and stroma
- Fibroblasts, derived from histiocytes and keratocytes, form scar tissue

Evolution of Resistance
- MRSA is found in normal flora of 24% of population
- MRSA likely developed for the penicillin-resistant strains of S. aureus (1944)
- MRSA strains are 82-92% resistant to the fluoroquinolones
- Overuse of antibiotics

Fighting MRSA
- Trimethoprim is 93.9% effective
- Cycling between different classes of antibiotics e.g. aminogycosides and fluoroquinolones
- New beta-lactam antibiotics – carbapenems (not yet approved)
- Rapid, efficient recognition
- Beware of blepharconjunctivitis and dacryocystitis – treat with bacitracin ointment, sulfa drops, Polytrim

Treating MRSA Infection
- Culture and sensitivity
- Vancomycin, fourth generation fluoroquinolones, gentamycin, sulfacetamide, and bacitracin

MRSA following Lasik or PRK
- Visual outcomes of 12 patients : 2 eyes required excision of the necrotic flap and 2 eyes required PKP and 4 eyes are pending PKP (46%)
- AJO 2007:143:4:629-34

"Dealing with Flaps Mishaps"
Mohamed Shafik, MD PhD

Q 1
- In your LASIK practice, are you still using mechanical microkeratome?
  A. Yes
  B. No

Q 2
- In your LASIK practice, Did you ever have a flap button hole?
  A. Yes
  B. No

Q 3
- In your LASIK practice, Did you ever have a torn flap?
  A. Yes
  B. No
Incidence of intraoperative flap complications in laser in situ keratomileusis
Jason M. Jacobs, MD, Michael J. Taravella, MD

84711 primary LASIK in 28 c
- 0.099% Partial flaps (84)
- 0.070% buttonholes (59)
- 0.087% Tom Flaps (74)

Incidence, management, and visual outcomes of buttonholed laser in situ keratomileusis flaps
Hani S. Al-Meziane, MD, Sarah A. Al-Ammar, MD, Sarah Al-Chaerian, MD

Of 4250 primary LASIK procedures, 17 eyes (0.4%) with buttonholed flaps were identified.

Buttonholes occurred with the Hansatome macrokeratome in 64.7% of eyes and with the Moria microkeratome in 35.3% of eyes, the incidence of buttonholed flaps was 0.62% and 0.19%, respectively.
CONCLUSIONS: Buttonholed flaps occurred more frequently in the second of 2 consecutively treated eyes. Microkeratomes that produce a larger diameter flap were more likely to produce flap buttonholes. The least loss of BCVA was achieved when LASIK was aborted and then repeated after refractive stability.


- Transepithelial photoablation keratectomy/photorefractive keratectomy with adjunctive mitomycin-C for complicated LASIK flaps
  - Laura T. Muller, MD,rogent M. Cantal, MD, Randy J. Epstein, MD, Richard F. Dennis, MD, Paras A. Mabrut, MD

- Mitomycin-C assisted photorefractive keratectomy in the treatment of buttonholed laser in situ keratomileusis flaps associated with epithelial ingrowth
  - Suphi Taner, MD, Jörg M. Koch, MD, Samir A. Mekki, MD, PhD, Dimitri T. Azar, MD

- Group III:
  - 5 eyes of five patients with LASIK flap complication; 3 had buttonhole and 2 had torn flap.

- Transepithelial PTK/PRK was performed using VISX Star S4 Excimer LASER System

- "Laser scrape" for central 6.0 mm with an epithelial setting of 50 µm

- Transepithelial PTK was first performed for cases with irregular corneal topography using 6.0 mm laser spot size and carbamoylmethylcellulose sodium 1% as a masking agent.

- Transepithelial PRK was done for the most current stable refraction

- The programmed myopic refractive error was reduced by 20% for cases with regular topography and by 50% for cases who had PTK.

- After ablation, A sterile sponge soaked in 0.02% MMC was applied to the bed for 20 seconds.
- The ocular surface was irrigated by 30 ml chilled BSS.
- CL was applied for 4 to 6 days.
- Fluoroquinolone antibiotic and Prednisolone acetate 1% 4 times a day for one week
- Prednisolone was tapered over subsequent 3 weeks.

**Methods**

**Group III (Post LASIK Flap Complication)**

- Mean interval between initial LASIK Flap Complication and PTK/PRK/MMC: 7.2 weeks
- Mean Postop. SE: -0.55 0.37 D
- Mean Postop. UCVA: 20/25
- Mean Postop. BSCVA: 20/20.2

**Results**

**Group III (Post LASIK Flap Complication)**

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age</th>
<th>Sex</th>
<th>Eye</th>
<th>Flap Complication</th>
<th>Refraction</th>
<th>Post Complication Refraction</th>
<th>UCVA</th>
<th>BSCVA</th>
<th>Date of Initial LASIK</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>26</td>
<td>F</td>
<td>OD</td>
<td>Buttonhole</td>
<td>-0.50 -1.75 X 100</td>
<td>-0.75 -1.75 X 100</td>
<td>2000</td>
<td>2000</td>
<td>2000</td>
</tr>
<tr>
<td>2</td>
<td>25</td>
<td>M</td>
<td>OS</td>
<td>Torn flap</td>
<td>-1.00 -1.00 X 15</td>
<td>-1.00 -1.00 X 100</td>
<td>2000</td>
<td>2000</td>
<td>2000</td>
</tr>
<tr>
<td>3</td>
<td>33</td>
<td>F</td>
<td>OS</td>
<td>Buttonhole</td>
<td>-0.00 -2.25 X 100</td>
<td>-1.25 -1.25 X 100</td>
<td>2000</td>
<td>2000</td>
<td>2000</td>
</tr>
<tr>
<td>4</td>
<td>27</td>
<td>F</td>
<td>OS</td>
<td>Torn flap</td>
<td>-0.50 -1.00 X 15</td>
<td>-1.00 -1.00 X 15</td>
<td>2000</td>
<td>2000</td>
<td>2000</td>
</tr>
<tr>
<td>5</td>
<td>30</td>
<td>M</td>
<td>OD</td>
<td>Buttonhole</td>
<td>-1.00 -2.00 X 10</td>
<td>-1.00 -2.00 X 100</td>
<td>2000</td>
<td>2000</td>
<td>2000</td>
</tr>
</tbody>
</table>

**Case 1**

25 Ys old lady
Flap Button hole

Central triangular scar
-5.25 -1.75 X 100
Transscleral PRK/MMC
(6 weeks later)
- Mean Ablation depth was 63 ± 13 μm (45 – 85 μm)
- Mechanical epithelial removal (Amoil's brush)
- 6 mm OZ with 1 mm transition zone
- Post-ablation MMC application (0.02% for 20 seconds)
- Bandage CL with routine postop regimen

Thank You
“Management of Highly Aberrated Corneas After Keratorefractive Surgery”
Mohamed Shafik, MD PhD
WFG Laser Vision Correction using the iDesign System

- High-resolution sensor maximizes capture rates
  - High-resolution Hartmann-Shack wavefront sensor
  - Faster tomographic scanning
- Faster treatment time
- Posterior corneal ablation
- Increased resolution:
  - Ability to achieve more patients
  - Improved spot quality, reduced spot overlap
  - Easier to detect higher order aberrations

The Time-Honored WF Ablation!!
JRS-December 2013

Objectives

To evaluate the visual, refractive, contrast sensitivity, and aberrometric outcomes in a group of highly aberrated corneas undergoing wavefront-guided LASIK surgery using the iDesign high definition aberrometer and the Star S4iR excimer laser platform from Abbott Medical Optics

Subjects & Methods

- 9 eyes of 9 patients with highly irregular cornea (6 females, 3 males) (Age: 20 to 52 yrs.)
- Honus Vision Correction Center, Alexandria
- Nov. 2012 to August 2013
- 2 clinical groups:
  1- Post RK (4 eyes)
  2- Post LASIK decenteration/irregular ablation (5 eyes)
CASE 2. Post RK

- 52 years old woman
- Had RK in 1995 (5 radial cuts at 3.5 mm OZ with 2 cuts invading optical zone). Presented with a halos, glare and ghosting
- UCVA 0.1
- Manifest Refraction +3.00 – 3.25 x 102
- BCVA 0.2
- OAC 583 μm
- Unavailable to date due to lack of capture with previous aberrometer

CASE 2. Post RK Preop Pentacam

Irregularity Indices

CASE 2. Post RK Preop iDesign MAP

CASE 2. Post RK Ablation Profile design over the irregular cornea

CASE 2. Post RK Results:
8 months after CustomVue PRK powered by iDesign

- Ablated tissue thickness 97 μm
- Manifest Refraction +0.60 =1.00 X 45

UCVA

CDVA

✓ Very significant improvement in Corneal Irregularity Indices and Aberrations

CASE 2. Post RK Preop vs Postop Pentacam
CASE 2. Post RK, Preop vs Postop Corneal Irregularity Indices

CASE 2. Post RK, Preop vs Postop iDesign Map

CASE 3. Post LASIK Decentration

- 25 y lady
- Had LASIK in July 2010 for -11.00 D. Presented with ghosting, poor night vision
- UCVA 0.1
- Manifest Refraction +2.50 -1.00 x 120
- BCVA 0.3
- CCC 468 µm

Untreatable to date due to lack of capture with previous aberrometer

CASE 3. Post LASIK Decentration Preop Pentacam

Irregularity Indices

CASE 3. Post LASIK Decentration Ablation Profile design over the irregular cornea
CASE 3. Post LASIK Decentration.
Results: 4 months after CustomVue LASIK, powered by iDesign.

Ablated tissue thickness 41 μm
Manifest Refraction -0.75 -0.5 X 180

Pre-Op

Post-Op

CASE 3. Post LASIK Decentration.
Preop vs Postop Pentacam

Results of the total Sample

Efficacy

Changes in Corrected Distance Visual Acuity after surgery
Conclusions

- The New iDesign System allows us to measure eyes with high aberrations that were not captured with previous aberrometers.
- With iDesign we avoid to treat the patients twice one with Topo Guided LVC to smooth the cornea and another ablation for refractive correction.
- The higher Iris Registration capture rate allows to center the ablation in the right place.
- Wavefront guided ablations are now my preferred choice for normal and highly aberrated eyes.
"Complications Management"
Eric D. Donnenfeld MD

Compliations Management
Eric Donnenfeld, M.D.
Ophthalmic Consultants of Long Island

History
- 44 year old healthy Hispanic male
- Bus driver wants to be a court officer
- No ocular or medical problems
- Presents for refractive surgery

Pre-op Exam
- Pre-operative refraction
  - OD: -4.25 -1.00 x 90° 20/20
  - OS: -4.50 -1.00 x 90° 20/20
- Central pachymetry
  - OD 500 microns
  - OS 504 microns
- Keratometry OD 42/43, OS 42.25/43/25

Keratoconus and Corneal Ectasia After LASIK
Perry S. Binner, MD; Richard L. Lindstrom, MD; R. Orville Studt, MD, PhD; Eric Donnenfeld, MD; Helen Wu, MD; Peter McDonell, MD; Yaron Rabenowitz, MD

"Consider surface ablation in patients with topographic findings without clinical disease with an informed consent."
Journal of Refractive Surgery, 2002; 18:156-762
Journal of Corneal Refractive Surgery, 2006; 11:1263-1264

\[\text{PRK is safer than LASIK because there is a smaller chance of ectasia.}\]
History

- Patient underwent bilateral uneventful PRK with the VISX S4 IR Excimer Laser - 2/24/05.
  - Bandage contact lens
  - Prednisolone acetate 1%
  - 4th generation fluoroquinolone
  - NSAID QID.

Post-Op Day #1

- UCVA 20/40 OU with bandage contact lenses in place.
- Minimal discomfort.
- Patient told to stop NSAID.

Post-Op Day #2

- Vision OD 20/100 OS 20/70
- Lid edema OU/No pain
- Subepithelial infiltrates OD
- No hypopyon or ulceration
- Cornea cultured OD
- Fluoroquinolone increased to Q2H OU
- Follow up 16 hours

Post-Op Day #3

- Finger counting vision OD.
- 4 x 4 mm inferior paracentral infiltrate OD.
- Started enconemycin 25 mg/ml every 30 minutes, oral doxycline 100 mg twice daily, fluoroquinolone continued q2 hours.
- Stopped prednisolone acetate 1%
- After 48 hours, culture of corneas and lids revealed Methicillin-Resistant Staphylococcus Aureus.

ASCRS Survey 2004: Infections after LASIK and PRK

- % Distribution of Infections

MRSA Keratitis POD #7 after PRK

Corneal Perforation POD #7

Cyanoacrylate Glue Applied
Clinical Course

- Glue removed 1 month after application.
- BCVA OD 20/400.
- Cornea 75% thinned with central scar.
- Uneventful PK OD 69/95.

Clinical Course

- Sutures removed post-operative month #9.
- Refraction 1 year after PK
  - OD -5.00 -0.25 x 95° 20/20
  - OS plane 20/20
- Patient complains of astigmatism and contact lens intolerance.

Wavefront After PK

"LASIK is safer than PRK because of the reduced risk of infection."

Final Outcome

- Minimal astigmatism but enormous high order aberrations (1.48 microns).
- Patient underwent VISX S4 IR Excimer wavefront guided photoablation.
- Final Refraction and Vision:
  - Plano OU with 20/20
  - Reduction in HOAs.

Conclusion

- PRK can be employed to treat forme fruste keratoconus.

Conclusion

- Precise registration with control of cyclotorsion allows us to treat irregular corneas, including forme fruste keratoconus and following penetrating keratoplasty.¹ ²

- Bacterial keratitis after PRK and LASIK can be visually devastating.
- MRSA keratitis is rare but must always be suspected.

¹Denkert KD, JCRS, 2006.
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