Mastering epi on and epi off CXL lessons learned over 14 years!

From our Athens team: CXL contributions

- 2nd team to CXL **2002**
- Combining high fluence CXL with topo-guided reshaping of irregular corneas: **2005**
- Higher fluence: **2006**
- CXL and Kpro: **2006**
- Intrastralomal treatments through femto-pockets: **2007** (ESCRS)
- LASIK Xtra: **2008** (ESCRS)
- LASIK Xtra for hyperopia: **2011** (ASCRS)
- Combining CXL and AK: **2012** (ESCRS)
- Refractive CXL: **2013** (AAO)

**When to CXL?**

Multiple corneal imaging options:

- Placido disc topography
- Scheimpflug tomography
- OCT
- Multi color LED spot
- reflection topo (Cassini)

Financial interests, consult for:

- Alcon / Wavelight
- Allergan
- Avedro
- KeraMed
- i-Optics
- ISP Surgical
- Optovue
- Zeiss
34 y/o F physician other eye AP X 3 years, getting married wonders if right eye is stable vision 20/20, K,s pach stable

Post-LASIK ectasia?

Most topometric asymmetry indices worse!
Topo-guided partial PRK

1- Topolyzer: Placido disc topography
2- Pentacam (Oculyzer)
3- Pentacam HD (Oculyzer II) - Refractive suite
4- Vario (placido disc + pupil sensor + iris recognition + limbal landmarks recognition)

WaveLight® FS200
Femtosecond Laser

WaveLight® EX500
Excimer Laser

The Athens Protocol 4 steps:
same day PTK > topoPRK > MMC > CXL (6mW/cm² x 15 min)

1- PTK
2- topo-guided PRK
3- 30" MMC
4- CXL

Athens Protocol (topoPRK + CXL) KCN epithelial changes

Examination Date: 04/20/2018, SS=33.0
Epithelium Map

Examination Date: 04/20/2018, SS=53.4
before
after
Step 4: attempted Rx to 0, OZ to 5 or 5.5mm, cyl axis to match topo axis not refractive axis

Average K from 48.5 to 44
Refraction -2.5-4.5@155 (20/70) to -1-1.5@10 (20/20)

5 year follow up in a 15 y/o
Oculink Vs Topolink in Athens Protocol

Oculink (Pentacam driven) appeared more effective!

Prophylactic higher fluence CXL in LASIK a novel technique

CXL meeting Dresden 08

Henry Perry, MD and A. John Kanellopoulos, MD
Clinical Associate Professor New York University Medical School
Director, Laservision.gr Institute, Athens, Greece

Cornea

Brillouin Microscopy of Collagen Crosslinking: Noncontact Depth-Dependent Analysis of Corneal Elastic Modulus

Giuliano Scarcelli,1,2 Sabine Kling,3 Elena Quijano,5 Roberto Pineda,5 Susana Marcos,5 and Seok Hyun Yun1,2,4

Cornea

Brillouin Optical Microscopy for Corneal Biomechanics

Giuliano Scarcelli,1,2 Roberto Pineda,5 and Seok Hyun Yun1,2,4

Biomechanical assessment of CXL
Other options: Pascal ORA, Corvis
Avedro’s Brillouin phonon spectrometer

Cornea

epi-on = ¼ of epi-off

Léon Brillouin

Léon Nicolas Brillouin (1842–1929)
Commercial device by Avedro in 2004

6 months myopic treatments 2D flattening!

Is CXL a refractive procedure?
Most investigators speak of “disease reversal” when flattening occurs after CXL in ectasia
This is a simple 3mW CXL-alone case from 2005
No scar developed, Now 2013 has Flattened 12D!!!
Novel Avedro KXL-II Device
Riboflavin penetration captured by Build-in Scheimpflug image

Myopic profile central 4mm OZ transepithelial 4min Paracel+6min VibexXtra

PiXL custom topo-assisted 7 months
Toric profile-transepi: 4min Paracel+6min VibexXtra

8 month topography-customised tran-epithelial CXL treatment

Time 2 minutes: 58 seconds Energy 4.0 J/cm²
Time 10 minutes: 22 seconds Energy 14.0 J/cm²

Customized astigmatism correction

Customized CXL for KCN!
KCN s/p Athens Protocol in 2006 residual cone and cylinder 3 months after PiXL it appears to work in CXL corneas as well.

The myopic shift (hyperopia-presby treatment)

"profile Hyperopic" oz 6-9mm 
“hyperopic PTK” 6-9oz 30 microns

Placido topo data
Our current CXL protocols

1- Athens Protocol: topo PRK +10’ x 10mw/cm²
2- LASIK Xtra: 1’ (90”) 30mW/cm² all HYPEROPES
3- PRK Xtra: 1’ (90”) 30mW/cm²
3- femtoAK Xtra: 3’ 30mw/cm² no soaking!
4- Cataract incision Xtra: 45mW/cm² for 2.5 min
5- TransepICXL: 0.25% ribo + 30mW X 3’
6- Infection: 0.25% riboflavin + 45mW/cm² x 5’

Conclusions CXL

CXL can stabilize ectasia, cornea melt, infection
Topography-guided PTK and CXL synergistic
CXL in routine LASIK= LASIK Xtra
CXL refractive treatments proving safe and effective for small refractive errors
Future: pattern CXL, titratable CXL

My opinion of the future of refractive surgery?
• Refractive femto corneal lenticule removal
• Fine-tuned and stabilized by pattern CXL
  (adjust small refractive errors, adjust asphericity etc)
• all through the original femto pocket