70 year old white male

Chief Complaint: Debilitating glare from bright lights at night

Family history: Mother had corneal transplants (penetrating keratoplasty) in both eyes 25 years ago

Best Corrected Vision: 20/30 OU

Brightness Acuity (Glare) Testing:
20/200 OD; total washout (“LP”) OS
Fuch's Dystrophy

Endothelial pump cells atrophy leaving spaces/clumps (guttata) and eventual corneal edema

Pleomorphism & polymegathism

Autosomal dominant endothelial layer

ECC

Identifying Fuch's Dystrophy
Incremental suture removal starting at 3-6 months post-op.

Steroid Medication

Astigmatism becoming more regular.
DSEK
Descemet's Stripping Endothelial Keratoplasty (DSEK/DSAEK)
Removes a. Descemet's b. Endothelium

DMEK
Descemet's Membrane Endothelial Keratoplasty
Removes a. Descemet's b. Endothelium
Insert a. Descemet's b. Endothelium

DMEK vs. DSEK-Acuity

DMEK vs. DSEK - Graft Adhesion

Rebubble rate

70 DMEK vs 62 DSEK

DMEK
DSEK

8.6% 3.2%

Rebubble rate

Risk of Transplant Rejection

Risk of Transplant Rejection at 1 Year and Probability at 2 Years

DMEK
DSEK

0.7% 1%

Risk of Transplant Rejection

Post-Op

• Day 1:
  – VA: 20/400
  – IOP: Variable
    • LPI pre-op to prevent pupillary block
    • Occasionally need to burp
  – Antibiotic 4x/day
  – Difluprednate 4x/day

Post-Op

• Week 1:
  – VA: Variable
    • If good = attached
    • If poor = small detachment
      – Re-bubble
  – Difluprednate 4x/day
    • Monitor IOP
Post-Op

- Month 1:
  - VA: good
  - Difluprednate 4x/day
    - Monitor IOP
    - If elevated, change to prednisolone or loteprednol

Post-Op

- Month 3
  - VA: good
  - Steroid: 2x/day until 4 months post op
    - Then change to 1x/day for 1 year
Corneal Collagen Cross Linking and Refractive Update

CC: My vision continues to get worse. Work is getting more difficult, and I am worried it will continue to get worse.

VAcc:      OD 20/40    PH: NI
OS 20/70

PeHx:  KCN diagnosis x 1 yr
       CL's x 10 yrs

PmHx:  Unremarkable

Meds:  None

Allergies:  NKDA

Case: 28 Year Old Male

Some Things are Just A Bad Idea
KCN: Old Mantra
Diagnose → Monitor → Spec. CL → PKD/DALK

KCN: New Mantra
Diagnose Early → Stop Progression → Rehabilitate VA
Cross-linking Procedure

Corneal epithelium is debrided, as is done in PRK.

Riboflavin eye drops (vitamin B2) are applied to the cornea.

The riboflavin film is maintained with reapplication of drops at 2 minute intervals until the stroma is saturated (20 minutes).

UVA light (365nm) is shined on the eye for 30 minutes (conventional technique).

A bandage lens is placed. Follow-up care is similar to PRK.

---

Post-operative course: What’s normal?

**Day 1-5:**
- Discomfort as epithelium heals
- (BCL in place)
- Sensitivity to light
- Tearing
- A reduction and fluctuation in vision

**Day 5-30:**
- Comfortable, sensitivity decreasing
- Hazy but improving vision back to baseline
- Typically relying on spectacles for correction
- No eye rubbing

**Day 30 to month 3:**
- Corneal remodeling (fluctuation)
- +/- Progressive improvement in vision
- Ability to wear previous CL correction
- @ 3 months, consider refit for contact lens
Postoperative corneal haze

Completed Phase III Study Keratoconus

Keratoconus Progression After Corneal Cross-Linking in Eyes With Preoperative Maximum Keratometry Values of 58 Dipters and Steeper

Samuel C. Gourley, MD, Emory University School of Medicine, Prof BA, and Reem E. Faruk, Prof MD
The Impact of CXL on Corneal Transplantation Rates

Sandvik et al., Cornea 2015;34:991–995

KXL Treatments
Keratoplasties
for Keratoconus
53% reduction
In Norway
Oslo University Hospital

OD 1 Month PO:
VA RGPorx: 20/25

OS 4 Month PO:
VA CL: 20/25

Contoura™ Vision System: Devices Used

WaveLight® Topolyzer™ Vario
Diagnostic Device

WaveLight® EX500 Excimer Laser System
Objective
1. Anterior-surface normalization
2. Improved visual rehabilitation

What is SMILE?
SMall Incision Lenticule Extraction

How does SMILE differ from LASIK?
Series of lamellar resections
1st lamellar cut defines posterior surface of lenticule
2nd side cut defines lenticule diameter
2nd lamellar cut defines anterior surface of lenticule/posterior surface of attached cap
2nd side cut creates incision for removal of lenticule
ReLEx SMILE
Visual Recovery vs. LASIK

Prospective Randomized Trial comparing 50 femto LASIK pts to 50 SMILE pts
Preop and 3 month postop

Dry Eye

Prospective Randomized Trial comparing 50 femto LASIK pts to 50 SMILE pts
Preop and 3 month postop
Growing Population for Cataract Surgery


Cataract Surgery is not just Rehabilitative Surgery

Cataract Surgery is
Refractive Surgery
Femtosecond Laser-Assisted Cataract Surgery (FLACS)

- Decreased Ultrasound Energy (30%)
- Reproducibility
  - Rhexis
  - Incisions
  - Astigmatic Keratotomies
  - Effective Lens Position?
  - Refractive Outcomes?
Zepto Capsulotomy

Implant Options

Toric
- Tecnis Toric, AcrySof IQ Toric
- Cylinder powers
  - 0.75-4.11
- Residual astigmatism can be a problem
  - Rotate IOL
  - Laser Fine Tune
  - LRI's
  - Glasses or Contacts
Astigmatic Keratotomy vs. Limbal Relaxing Incision

- AK
  - central = bigger effect
  - 1:1

- LRI
  - Peripheral = less effect
  - Hyperopic Shift

ReSTOR +2.5 w/ ACTIVEFOCUS
ReSTOR 2.5 w/ ACTIVEFOCUS Toric

Central portion 100%
dedicated to distance

Toric

Tecnis Multifocal

Anterior aspheric wavefront
Less spherical aberration

Posterior diffractive surface

Tecnis Symfony

- Extended depth-of-focus lens (EDOF)
- Better near distances than monofocal, but not as well multifocal
- Glare and halo still possible
- Diffractive optics to...
  - Correct chromatic aberration
  - Extend the range of quality vision
Light Adjustable Lens-What’s Special?

- regular silicone polymers
- mobile, silicone subunits, called photosensitive macromers

<table>
<thead>
<tr>
<th>LAL Composition</th>
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<tbody>
<tr>
<td>Photosensitive silicone macromer</td>
</tr>
<tr>
<td>Polymerized macromer</td>
</tr>
<tr>
<td>Unpolymerized macromer</td>
</tr>
<tr>
<td>diffuses to central region &amp; causes swelling</td>
</tr>
</tbody>
</table>

Post Op Adjustable IOL Prediction to Prescription

- Standard cataract implant procedure
- Residual refractive error is determined using standard phoropter
- Refractive error is entered into Light Delivery Device
- Desired light profile delivered using machine

- Standard cataract implant procedure
- Residual refractive error is determined using standard phoropter
- Refractive error is entered into Light Delivery Device
- Desired light profile delivered using machine
Trifocal

- Goal of Trifocality:
  - continuous visual acuity over near, intermediate and distance
- Minimal photic phenomena with the greatest amount of light reaching the retina for optimal contrast sensitivity

Trifocal Panoptix

Trifocal IOL

Single-site 6-month data from a prospective, multi-center, confirmatory trifocal IOL trial were analyzed

Subjects (n=16) were bilaterally implanted with the trifocal IOL (TFNT00) after femtosecond laser cataract surgery

Key effectiveness testing included:
- Photopic visual acuity at distance (4m), intermediate (66 cm) and near (40 cm)
- Binocular distance corrected defocus curve using an electronic visual acuity test system (M&S Technologies)

Note: This trifocal IOL is currently not approved or available in the US
Visual Acuity Outcome at 6 month post-op

<table>
<thead>
<tr>
<th></th>
<th>Distance (4 m)</th>
<th>Intermediate (66 cm)</th>
<th>Near (40 cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Binocular UCVA (logMAR)</td>
<td>-0.02 ± 0.11</td>
<td>0.01 ± 0.10</td>
<td>0.07 ± 0.11</td>
</tr>
<tr>
<td>Binocular DCVA (logMAR)</td>
<td>-0.05 ± 0.07</td>
<td>-0.01 ± 0.09</td>
<td>0.05 ± 0.08</td>
</tr>
<tr>
<td>Monocular UCVA* (logMAR)</td>
<td>0.08 ± 0.12</td>
<td>0.12 ± 0.13</td>
<td>0.16 ± 0.12</td>
</tr>
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<td>Monocular DCVA* (logMAR)</td>
<td>-0.02 ± 0.09</td>
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Patients implanted with the trifocal IOL had a binocular UCVA and DCVA of 0.1 logMAR or better at all tested distances.

Note: This trifocal IOL is currently not approved or available in the US.

Binocular distance corrected defocus curve at 6 months

- The mean binocular VA of 20/25 or better was achieved at the defocus range of +0.50 D to -2.50 D.
- Standard deviations (SD) were less or equal to 6 letters.

IC-8® Small Aperture Lens

IC-8®: Investigational Device. Limited by Federal (or United States) law to investigational use.
Causes of unhappiness


DexMoxi and Dropless or Drop a Day Cataract Surgery

- Dropless or Drop-a-Day is an injection of an antibiotic & steroid combination in the eye at the time of surgery.

Preparation:
1. dexamethasone
2. moxifloxacin

One intracameral injection
Safety?

Take Home Point
1. This study showed a 5-fold decrease in endophthalmitis with intracameral cefuroxime.

Kaiser Study

- No injectable drug reactions at any point.
- 22 (2100%) fold decrease in endophthalmitis from 2007-2011.

DEXTENZA

Post-Surgical Ocular Pain

<table>
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DEXTENZA

Absence of Anterior Chamber Flare

Dexycu

Updates on Retina Surgery
Most Common Retinal Conditions

- Diabetes Mellitus
  - 4.2 million
- Age Related Macular Degeneration
  - 11 million
- Retinal Detachments and Tears
  - 6% with tears
  - 0.3% with RDs

Surgical Treatment Options

Lasers
- Panretinal Photocoagulation
- Focal Laser
- Cryopexy
- Retinopexy
  - Pneumatic

Surgery
- Vitrectomy
  - Air/Fluid
  - Silicone Oil
  - Gas
- Scleral Buckle
Pars Plana Vitrectomy

What is it?
- Removal of vitreous and replaced with air, gas, or oil
- Three Port Core Vitrectomy
- Can be performed with other procedures

Reasons Why
- Inability to visualize/detect breaks due to opacities
- Retain retina
- Vitreous hemorrhage, giant retinal tear, PDR, TRD, ERM, Endophthalmitis, intraocular foreign body, proliferative vitreoretinopathy, retained lens fragment, dropped lens

Treatment for Diabetic Retinopathy
- Panretinal Photocoagulation
  - Effective Tx (DRS)
- Focal Laser
  - Microaneurysms >500 microns away from fovea
  - Reduce moderate vision loss by 50% (ETDRS)
- Pars Plana Vitrectomy (PPV)
  - Blood not clearing from vitreous after 1-6 months
  - Best done within 6 months of hemorrhage (DRVS)
  - Anterior segment neovascularization
  - Alleviate retinal traction (TRD, ERM)
  - When PRP isn’t enough

Panretinal Photocoagulation
- Effective Tx (DRS)
Panretinal Photocoagulation
- Effective Tx (DRS)
Panretinal Photocoagulation
- Effective Tx (DRS)
Panretinal Photocoagulation
- Effective Tx (DRS)
PDR Case

- 44 y/o Caucasian male with history of Type 1 DM with PDR without macular edema OD and vitreous hemorrhage OD
- H/o multiple Avastin injections and PRP
- Schedule:
  - 1. Pars Plana Vitrectomy
  - 2. Fluid Air Exchange
  - 3. Laser Endophotocoagulation
  - 4. Membrane Peel

PDR Case

- Vision has improved from 20/150 to 20/50-2 following surgery
- No OCT obtainable prior to surgery due to vitreous hemorrhage
- 1 month following: vitreous clear, s/p PRP, residual adherent vitreous inferiorly, and retina attached

Treatment for Diabetic Retinopathy

- Pars Plana Vitrectomy (PPV)
  - Three Port Core Vitrectomy
  - Ways to Dissect Fibrovascular Membranes
    - Segmentation
    - Detachment
    - Endolaser

Complications of a Vitrectomy

Intraoperative
- Additional hemorrhaging
- Choroidal hemorrhage
- Posterior/peripheral breaks

Postoperative
- Retinal breaks
- Elevated IOP
  - Gas overfill, steroid use, inflammation, neovascularization, angle closure
- Cataract
- Corneal Decompensation
- Hypotony
- Endophthalmitis
- Gas/Oil Spillover in Anterior Chamber
Differentials

- Trauma
  - Hemorrhage
  - Commotio
  - Hole
- Solar
- Vascular
  - BVO
  - JFT
  - Coat's
  - CNVM
  - CRAO
- Inflammatory
  - MFC, POHS
  - PIC
  - CNVM
- Genetic
  - Pattern Dystrophy
  - Neuronal Storage
  - Angioid Streaks
  - Early Stargardt's

Macular Hole Stages

***Consider surgical intervention for stage 2 or greater***
Macular Hole Treatment

- Spontaneous hole closure rate 1%
- Vitrectomy hole closure rate 80-85%
- Post vitrectomy cataract 70% at 1 year
- Post vitrectomy RD 3% at 1 year
- Post vitrectomy VF defect in 10-15%
- Risk of fellow eye hole 10% without PVD
- Risk of fellow eye hole 2% with PVD

Retinal Tears and Detachments

- Separation of neurosensory layers from RPE
- Three types:
  - Rhegmatogenous
  - Exudative
  - Tractional
- Emergency?

Treatment of Rhegmatogenous Retinal Detachment

- Laser Photocoagulation
  - Formation of scar tissue around margin
  - Choroid & retina form adhesion in 1-2 weeks
  - Fluid reabsorption
  - Good for small tears
  - In office procedure
- Cryopexy/Cryotherapy
  - Formation of scar tissue around margin
  - Freezing probe over tear
  - Tears in hard to reach locations
  - Requires block
Treatment of Rhegmatogenous Retinal Detachment

- **Pneumatic Retinopexy**
  - SF6 gas bubble injected into eye—tamponade
  - Ideal for superior tears due to gas bubble rising
  - Breaks within 2 hours of each other
  - Can be performed with other procedures (i.e., retinopexy or cryopexy)
  - In-office procedure
  - Patient positioning

- **Pars Plana Vitrectomy**
  - Good for pseudophakes
  - 78% of US respondents preferred PPV vs. scleral buckle (ASRS)
  - Tamponade Agents
    - Air
      - Lasts 3-5 days
    - Sulfur Hexafluoride (SF6)
      - Doubles in volume
      - Lasts 10-14 days
    - Perfluoropropane (C3F8)
      - Quadruples in volume
      - Lasts ~60 days
    - Silicone Oil
      - Permanent & remain in eye until surgically removed
      - Float in vitreous cavity


Tamponade Agents used in Vitrectomy

- **Gas**
  - 1 surgery
  - Good for single, solitary break, and compliant patients
  - Positioning ~3-4 days
  - No flying until reabsorbed
  - Poor vision

- **Oil**
  - 2 surgeries
  - Good for inferior detachments, PVR, and less compliant patients
  - First 24 hours ➔ face down; but any position after
  - Hyperopic shift (~+8.00D)
Scleral Buckle

- **What is it?**
  - Physical support to retinal break by creating indentation by buckle
  - Use cryotherapy or laser photocoagulation to create adhesion between neurosensory retina and RPE
  - Remains permanently
  - Complications: diplopia, buckle extrusions, discomfort, myopic shift

- **Reason Why?**
  - Young phakic patient with traumatic RD
  - High myopia, extensive lattice, and numerous breaks
  - Chronic inferior RD with PVR
  - Recurrent RD

Vitreous Floaters

- **Options:**
  - Live with them
  - Pars plana vitrectomy
  - YAG vitreolysis

  - Some retinal specialists may recommend waiting a couple months
  - Signs correlate with symptoms
  - Risk for tears/detachments

Lasers for Floaters

Video Courtesy of Paul Singh, MD
Minimally Invasive Glaucoma Surgery (MIGS)

Procedures that have an ab-interno approach, are minimally atraumatic, with at least modest efficacy, extremely high safety and rapid recovery.


Schlemm’s Canal
Suprachoroidal
Subconjunctival
Dilation
Cutting
Ablation
iStent
Inject
Hydrus
Visco360
ABiC (Ab-interno Canaloplasty)
Kahook Dual Blade,
OMNI
Trabectome
Cypass
iStent Supra
Xen
InnFocus
iStent inject®
HENGERER (3 YEAR)
Long-term IOP Reduction at 3 Years¹

Consecutive case series with iStent inject in primarily OAG eyes in Germany²
- n=81 eyes of 55 patients
- Patients followed through 3 years, longer follow-up continuing
- Preoperative mean IOP was 22.6 ± 6.2 mmHg on an average of 2.5 medications

¹ Hengerer FH. Personal Experience with Second-Generation Trabecular Micro-Bypass Stents in Combination with Cataract Surgery in Patients with Glaucoma: 3 Year Follow-up. ASCRS 2018 Presentation.
² Preop vs. 12 month Postop
Aqueous Angiography Before and After Stenting
Alex Huang, MD, PhD

Hydrus Microstent
### HORIZON Trial

<table>
<thead>
<tr>
<th>Baseline IOP (mm Hg)</th>
<th>Cataract Only (n=187)</th>
</tr>
</thead>
<tbody>
<tr>
<td>after washout</td>
<td></td>
</tr>
<tr>
<td>25.5 (+/- 3.0)</td>
<td>26.4 (+/- 3.0)</td>
</tr>
<tr>
<td>24 months IOP (mm Hg)</td>
<td></td>
</tr>
<tr>
<td>after washout</td>
<td></td>
</tr>
<tr>
<td>17.4 (+/- 3.7)</td>
<td>19.4 (+/- 3.4)</td>
</tr>
</tbody>
</table>

Unmedicated at 24 months

| 1 preoperative med | 52.6% |
| 2+ or 3 preoperative med | 47.4% |

### Ideal Patient Candidate
CyPass Micro-Stent

COMPASS XT

~ 27% 5 years
> 30% ECL
**Xen 45 Gel Stent**

<table>
<thead>
<tr>
<th>Visits – IOP and Medications</th>
<th>Mean</th>
<th>Post-Op Concerns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medicated IOP</td>
<td>25.1 (3.7)</td>
<td>Hypotony 16 (24.6%)</td>
</tr>
<tr>
<td>Glaucoma Meds</td>
<td>3.5 (1.0)</td>
<td>Shallow at any time 1 (1.5%)</td>
</tr>
<tr>
<td>12 Month</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IOP</td>
<td>15.9 (5.2)</td>
<td>Shallow at any time 1 (1.5%)</td>
</tr>
<tr>
<td>Glaucoma Meds</td>
<td>1.7 (1.5)</td>
<td>Bleb needling 21 (32.3%)</td>
</tr>
</tbody>
</table>

76.3% of patients reported a mean diurnal IOP reduction of >20% from medicated baseline at 12 months

---

**Ideal Patient Candidate**

---

**Post-operative Considerations with MIGS**

1. Stopping GLC Meds
2. IOP Fluctuations, new baseline
3. IOP Spikes
4. Hyphema
5. Hypotony
How do we decide?

Trabecular Meshwork  Suprachoroidal  Sub-Conjunctival

Thank You!

justin.schweitzer@vancethompsonvision.com
wwhitley@vec2020.com