

## ANTERIOR SEGMENT REFERRAL CASES

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## NON-INFLAMMATORY CORNEAL THINNING, ECTASIAS

- ✘ Keratoconus
- ✘ Keratoglobus
- ✘ Pellucid Marginal Degeneration
- ✘ Posterior Keratoconus

## PELLUCID MARGINAL DEGENERATION

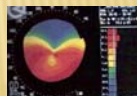
- ✘ Genetics
  - + No gender predilection, Females=Males
    - ✘ Keratoconus - F:M 2:1
- + Clinical Features:
  - ✘ Keratoconus variant, usually noted between 20 to 50 yoa
    - ✘ Keratoconus onset late teens, usually 5-10 years progressive, then stable by 30's to 40's. If later onset, milder course.
  - ✘ Bilateral
    - ✘ Keratoconus bilateral, but onset and severity asymmetric

## PELLUCID MARGINAL DEGENERATION

- ✘ Clinical Features:
  - + Protusion occurs above the area of thinning without iron lines or scarring
    - ✘ Dunlop Syndrome – “belly's done loped over belt”
    - ✘ Keratoconus – inferotemporal, area of thinning at area of apical steepening. Scarring a apex of cone, even apical nodule. Deep vertical striae (Vogt's lines) and Fleischer ring - iron line best seen with cobalt blue light
    - ✘ DDX: Contact Lens warpage – no iron lines or scarring like Pellucid h/w irregular astigmatism similar keratoconus.
      - ✘ Reversible with discontinuing CTL

## PELLUCID MARGINAL DEGENERATION

- ✘ Clinical Signs:
  - + Band of thinning inferiorly (4:00 to 8:00) separated from limbus
  - + Axial cornea clear but may protrude with high astigmatism
  - + No lipid deposition or neovascularization (DDX Terrien's Degeneration), not Ectasia
  - + No epithelial Defect unlike Mooren's Ulcer, not Ectasia
  - + Corneal Topography: Crab-Claw (Loop) or Kissing Doves Pattern



## PELLUCID MARGINAL DEGENERATION

- ✘ Treatment:
  - + CTL – scleral fits
  - + Surgical: difficult PKP, consider DALK, Lamellar Wedge resections or Corneal Imbrication (excision of stroma overlying thinned area with oversewing of tissue.



### ECTASIAS - GOAL OF SURGERY:

- MAKE EYE REFRACTABLE WITH GLASSES. CTL NOT POSSIBLE
- CLEAR VISUAL AXIS OF SCARRING, IF PRESENT.

▶ The cornea of an eye with keratoconus bulges outward, creating a cone-like shape and distorted vision.

▶ A healthy eye is more spherical in shape, allowing an image to come into focus clearly.

### AVOID CORNEAL TRANSPLANTATION?

- ✗ GPHCL
- ✗ Scleral lenses
- ✗ Corneal Cross linking
- ✗ Intacs

### CORNEAL CROSS-LINKING KERATOCONUS / LASIK ECTASIA

### CORNEAL CROSS LINKING WITH UV-LIGHT AND RIBOFLAVIN "CAUTIOUS NOD"

- ✗ FDA advisory panel "recommended" approval of riboflavin (Photrexa, Avedro) and Photrexa Viscous (with dextran) Feb, 2015
- ✗ More Data on Delivery system (KXL) and long-term efficacy (> 12 months)
- ✗ Treat progressive Keratoconus and Corneal ectasia after refractive surgery (LASIK)
- ✗ 2011 Orphan drug status

**IROC**

**Background of corneal cross linking**

1. Combined application of UVA and riboflavin (vit. B2)
2. Production of oxygen radicals
3. Induction of collagen cross-links

collagen fibril

collagen fibril

Prof. Dr. Michael Moehlen, 17.8.2005

### CROSS LINKING INDICATIONS

- ✗ elimination of transplants for keratoconus if it is *detected early*,
- ✗ single treatment for infectious corneal ulcers
  - + cytotoxic reaction of singlet oxygen
- ✗ palliative treatment avoiding surgery for marginal melts and bullous keratopathy.
  - + increased corneal rigidity, compaction of corneal lamellae

**IROC**

**Treatment procedure**

1. Topography Progressive type of keratoconus
2. Pachymetry Corneal thickness > 400 microns
3. Partial epithelium removal (abrasio)
4. Apply Riboflavin 1 drop every 2 min for 30 min.
5. Slit lamp inspection (blue light) Staining of anterior chamber
6. Start UV-illumination with UV-X, 1 drop of Riboflavin every 2 min for 30 min.

Prof. Dr. Michael Mrochen, ITR 2005

**COLLAGEN CROSS-LINKING COMPLICATIONS - EPI OFF TECH**

- ✗ Immediate post-op experience miserable
- ✗ Remove epith 10-11mm, then irradiate with UV – pain prolonged re-epithelialization
- ✗ *Death nearly all keratocytes in RX area*
- ✗ Repopulation occurs over time
- ✗ *Transient haze can be significant – 1 year\**
- ✗ vision worse several months
- ✗ Long term effects/stability unknown > 12 months

**ENDOTHELIAL KERATOPLASTY VARIATIONS:**

- ✗ DSEK - Decemets Stripping Endothelial Keratoplasty 120-220 microns
- ✗ DSEK (ultrathin) < 80-120 microns
- ✗ DMEK - Descemet's (Membrane) Endothelial Keratoplasty
- ✗ DMAEK (Hybrid) - DMAEK – Hybrid DMEK + DSEK

**CORNEAL CROSS-LINKING KERATOCONUS / LASIK ECTASIA**

- ✗ Best indication is in young patients with early topographic signs **BEFORE** disease progression
- ✗ Subtle topographic and optical improvement 3-5 yrs.
- ✗ Goal: stabilize cornea
- ✗ Consider X-linking in KC PRIOR TO ICL
- ✗ LASIK Ectasia: early experience disappointing
- ✗ Long term results?
- ✗ Not US FDA approved
- ✗ Are patients expectations reasonable?

**POTENTIAL CONTRAINDICATIONS**

- ✗ thin corneas where cytotoxicity could damage the endothelium\*
- ✗ Moderate keratoconus with unreasonable pt expectations
- ✗ Advanced keratoconus
- ✗ severe ocular surface disease where treatment could lead to the instability of the ocular surface.



**100 YRS : SO WHAT'S WRONG WITH PENETRATING KERATOPLASTY (PK)?**

### PK'S - COMPLICATIONS

- ✘ Ocular Surface Disease
- ✘ Glaucoma - Trabecular Meshwork damage
  - + Direct - avoid by doing smaller diameter graft
  - + Indirect - chronic steroids
- ✘ Immunologic Graft Rejection
- ✘ Infectious Ulceration
  - + Suppurative Infections

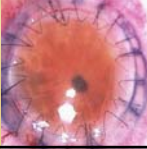
### PK'S LONG RECOVERY TIME

- ✘ 1 to 2 years
- ✘ Risk of Traumatic Wound Rupture

### PK'S IRREGULAR ASTIGMATISM/WARPAGE

- ✘ Sutures cause distortion
- ✘ Don't know final refractive result until sutures removed - 1 to 2 years post op
- ✘ Suture out irregular astig common
- ✘ If GPHCL intol - "*optical cripple*"
- ✘ Peripheral host tissue remains



### A PARADIGM SHIFT!

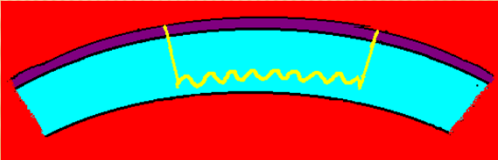
- ✘ The results of studies confirm why PK (full thickness) corneal transplantation is "the gift the keeps giving" - regraft is too often eventually required even in the absence of immunologic graft rejection!
- ✘ Inspires us to learn and refine corneal transplant techniques which DO NOT SACRIFICE recipient Descemet's membrane, thus preserving host endothelial cell cts that do not spontaneously decay, eliminating the possibility of endothelial cell rejection and perhaps extending graft survival to a lifetime!

✘ Penetrating Keratoplasty in Asian Eyes The Singapore Corneal Transplant Study Donald Tan et al Ophthalmology 2008

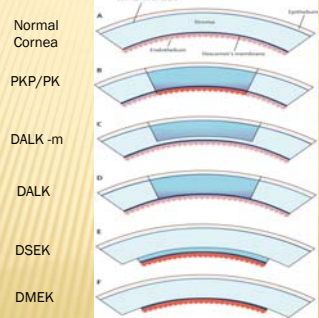
✘ Ophthalmology 2008 - Cornea Donor Study Investigator Group

### DEEP ANTERIOR LAMELLAR KERATOPLASTY (DALK) - CHALLENGE:

preserve Descemet's Membrane (18u) without perforating during dissection.



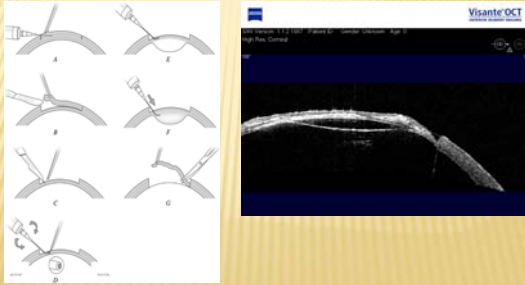
### DEEP ANTERIOR LAMELLAR KERATOPLASTY (DALK) CHALLENGE:



The diagram shows cross-sections of the cornea for different procedures:

- Normal Cornea:** Shows the natural structure with epithelium, endothelium, and Descemet's membrane.
- PKP/PK:** Shows a full-thickness graft replacing the entire cornea.
- DALK -m:** Shows a partial-thickness graft with a microkeratome cut.
- DALK:** Shows a partial-thickness graft with a hand-cut.
- DSEK:** Shows a partial-thickness graft with a hand-cut, leaving Descemet's membrane intact.
- DMEK:** Shows a partial-thickness graft with a hand-cut, leaving Descemet's membrane intact.

**DEEP ANTERIOR LAMELLAR KERATOPLASTY (DALK) BIG BUBBLE**



**DEEP ANTERIOR LAMELLAR KERATOPLASTY (DALK) - LAMELLAR**

- ✘ Subtotal Layer by layer stromectomy until reaching a deep plane.
- ✘ residual stroma less than 80u otherwise decrease BSCVA

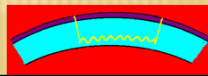
**DEEP ANTERIOR LAMELLAR KERATOPLASTY (DALK) ADVANTAGES: NOT OPEN SKY SURGERY**

Less risk:

- ✘ endophthalmitis
- ✘ expulsive choroidal hemorrhage

NO:

- ✘ anterior synechia or secondary glaucoma



**DEEP ANTERIOR LAMELLAR KERATOPLASTY (DALK) ADVANTAGES: \*\*RETENTION OF RECIPIENT ENDOTHELIUM\*\***

- ✘ No long term endothelial loss (reduces late graft failure) vs PK
- ✘ eliminate endothelial rejection
- ✘ Larger diameter grafts (8.5-10mm) vs (7.5-8mm) PK
- ✘ Expanded donor pool



**DEEP ANTERIOR LAMELLAR KERATOPLASTY (DALK) - ADVANTAGES**

Reduce/eliminate long-term topical steroid:

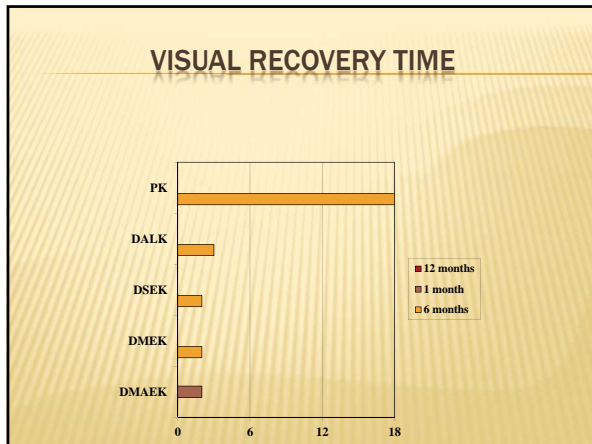
- ✘ Faster graft/host healing (large graft)
- ✘ Suture out faster (6 mos vs 1 yr -1.5yrs PK)
- ✘ Faster optical rehabilitation
- ✘ Reduced secondary cataract
- ✘ Reduce steroid-induced glaucoma




**DEEP ANTERIOR LAMELLAR KERATOPLASTY (DALK) - ADVANTAGES**

- ✘ Better graft "seating" because of retention of Descemet's membrane.
- ✘ (large dia) Suture-out astigmatism less, easier to control than PK, more refractile
- ✘ Visual acuity after DALK rivals and may surpass that after PK.
- ✘ Less corneal HOA - Higher Order Aberration + larger diameter grafts > 7.5mm





- ### DEEP ANTERIOR LAMELLAR KERATOPLASTY (DALK) - DISADVANTAGES
- ✗ still requires traditional graft suturing technique
  - ✗ During long learning curve – high conversion rate to PK
  - ✗ few cornea surgeons attempt
  - ✗ Few attempting large diameter
- 

### DALK (VS PK) FOR ANTERIOR CORNEAL PATHOLOGY

#### CONCLUSIONS:

“We avoid PK and instead highly recommend large-diameter DALK for most cases of Keratoconus, Pellucid Marginal Degeneration, RK or LASIK ectasia, stromal dystrophies and scars when surgery is required.”

Richard Erdey, MD   Daryl Kaswinkel, MD