



El Cairo, 25 January 2018



Corneal Transplant for Keratoconus: Current Options and Controversies



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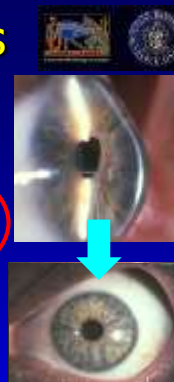
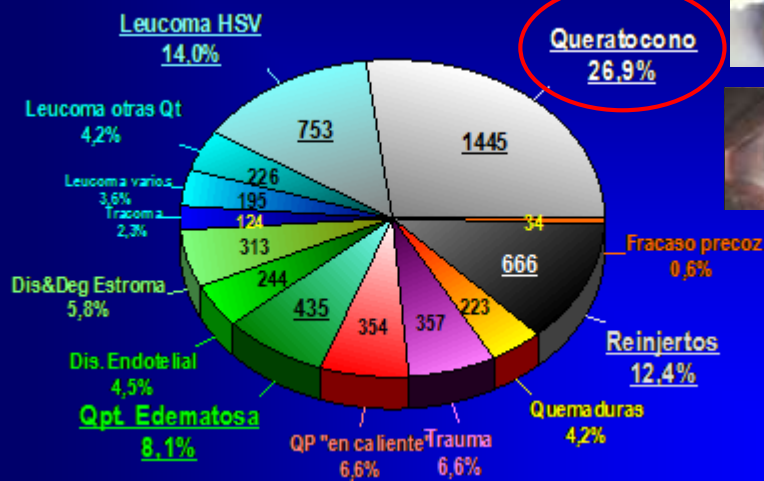
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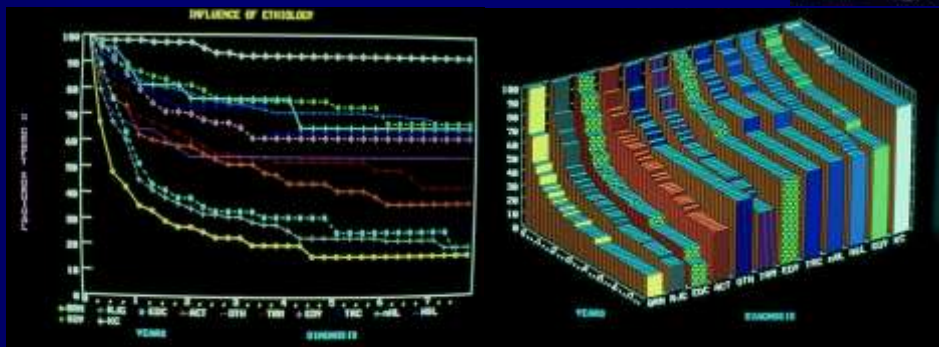


Queratoplasty for Keratoconus

Until recently **Nº1 indication** for PK in our region (> 25%).

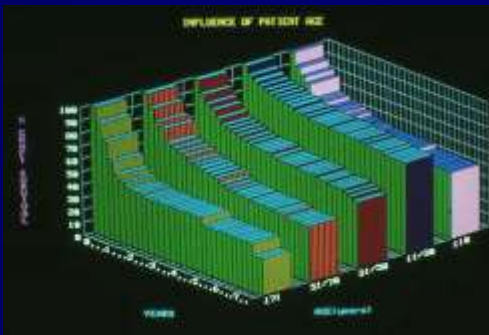


Results of PK for Keratoconus



- >2700 PK series (> 800 Keratoconus)
- Kaplan-Meier curves @8 years of follow-up
- **Most successful group (by far)**
- > 95% actuarial survival
- Many grafts remain clear > 30 a.

Factors: Patient Age (inverse)



Survival (actuarial) @8 y. f/u

Up to 10 y. » 50%

11-30 y. » 70%

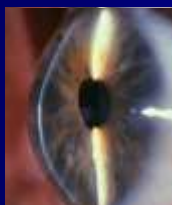
31-50 y. » 55-60%

51-70 y. » 40-50%

Over 70 y. » 25-35%

Logrank $p < 0.0000001$

In Keratoconus (>10 y./age):



Logrank $p = 0.09$ NS

Trend $p = 0.03$

Worsens w Age

In regrafts (>10 y./age):

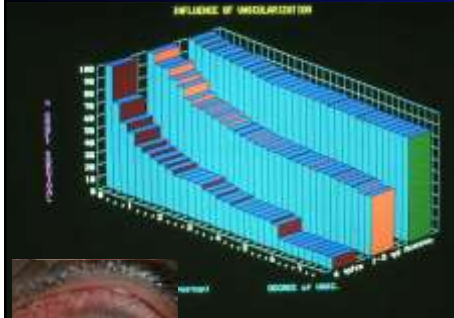


Logrank $p = 0.07$ NS

Trend $p = 0.04$

Improves w Age

Vascularization: also counts



NS in active keratitis

Vascularization	N	Obs	Exp	O/E	(O-E)/SE
Avascular	2	1	0.44	2.366	8.707
Fasc. 1-3 qdrts.	134	61	66.39	0.919	0.481
Fasc. 4 qdrts.	33	18	17.51	1.361	1.738

$\chi^2 = 3.08$ (2 degrees of freedom)
 $P = 0.2161272$ Difference is NOT SIGNIFICANT

Survival (actuarial @8y. f/u)

Avascular » 85%
 1 - 3 quadrants » 40-50%
 4 quadrants » 10-25%
 Logrank $p < 0.0000001$

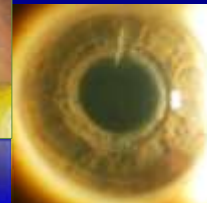
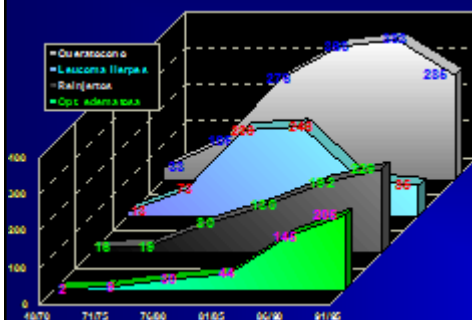


$p=0.02$ in Keratoconus

4 Quadr. (Group)	N	Obs	Exp	(O-E)/SE	Z	P	Q
1 Avascular	161	88	90.48	-2.19	-2.89	0.003	0.003
2 1-3 qdrts.	133	71	66.48	4.52	5.80	0.000	0.000
3 4 qdrts.	33	18	17.52	0.48	0.62	0.53	0.53

Totals: (Obs) 172 (Exp) 172 (O-E) 3.81 (SE) 2.84 (Z) 13.34 (P) 0.000
 Continuity: 0.000 (SE) 0.000 (Z) 0.000 (P) 0.000
 4th trend: 0.000 (SE) 0.000 (Z) 0.000 (P) 0.000
 Trend is SIGNIFICANT

Evolution of indications



- Indications for PK in Keratoconus diminish since the '90s
- Current options accelerate this trend
 - ▶ Conservative treatments (CXL, ICRS avoid trasplant)
 - ▶ Lamellar trasplant (DALK) whenever possible

Possible Controversies

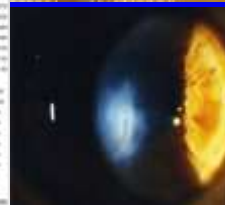
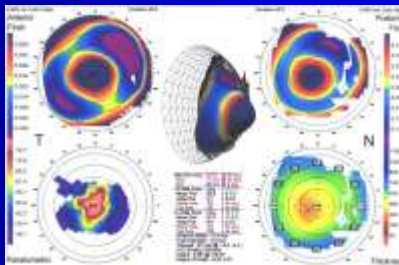


- What are the LIMITS for the transplant indication? *(until which stage can/shoud we try with conservative treatments)*
- PK vs. DALK
- Role of femtosecond laser

Current indications for Keratoplasty in Keratoconus



- *Bad vision not improving with optical correction*
- (semi)Rigid CL intolerance (incl. piggyback, etc. special CLs)
- Beyond indication for ICRS (Stage IV, etc.)
 - ▶ **K too high** (Kmax > 60-62 D)
 - ▶ **Pach too low** @5-6mm (not allowing effective ICRS)
- **Opacity** @visual axis (post hydrops, etc.)



PK for Keratoconus

Pros

- Long experience (>50 años)
- Very high survival (proven)
- Large diameter PK a viable option in some cases

Cons

- Rejection
 - rare in Kcone but possible
 - 1 episode in 18%
- Risk of traumatic rupture
- Progressive endothelial cell loss → Risk of late failure

Deep Anterior Lamellar K. (DALK)

- **Indications:** Whatever pathology *not affecting the endothelium*
- **Techniques:** Remove all stroma anterior to Dua's pre-Descemet Layer
 - Manual dissection
 - Lamellar "stripping" (Malbrán)
 - Spatules & I.O. Bubble (Melles)
 - **Neumodissection to Dua/Descemet ("big bubble")** (Anwar)



DALK for Keratoconus

Pros

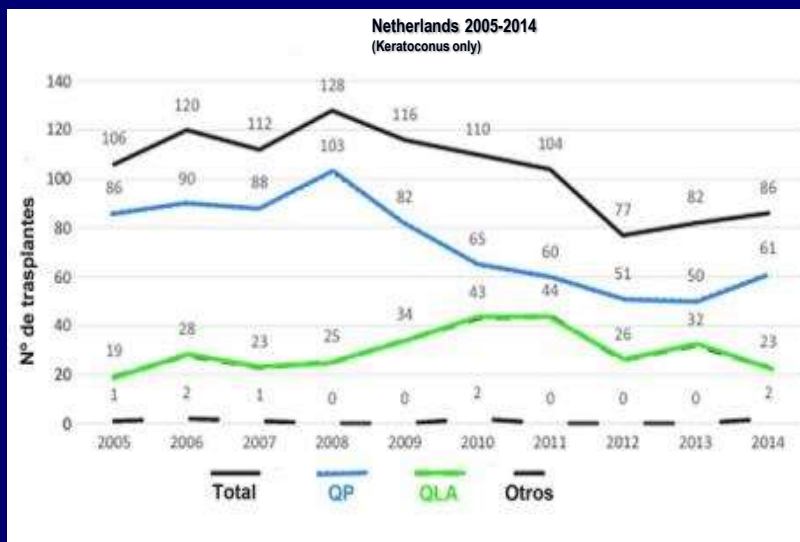
- Recipient endothelium preserved (check preop.!)
 - No rechazo endotelial
- Preserved globe integrity
 - Less risk of rupture in case of trauma



Cons

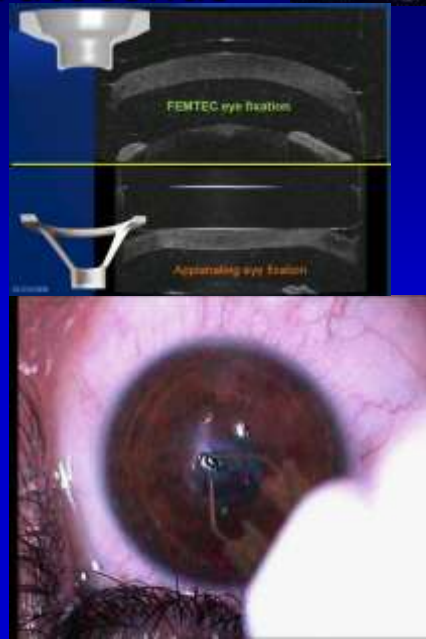
- Technical difficulty
 - Long learning curve
 - nn % PK conversion
 - May not be possible if broken DM (post-hydrops)
- Optical quality?
 - Similar if 'descemet' DALK
 - Not as good as PK if "pre-descemet" DALK
 - Does not avoid astigmatism
- Possible (specific) complications
 - Descemet detachment
 - Stromal rejection (too low Rx)
 - Interface ingrowth / opacities
 - Interface infection intractable

Evolution of Corneal Transplants for Keratoconus



FsL: Problems in Keratoconus

- Applanation lens over advanced cone → **distorted cut (oval)**
- How to avoid:
 - ▶ Curved lens (less applanation)
 - ▶ Liquid interface (no applanation)
 - ▶ **Cautery** conus tip (*W. Culbertson*) to flatten it before applanation



FsL Complex Profiles

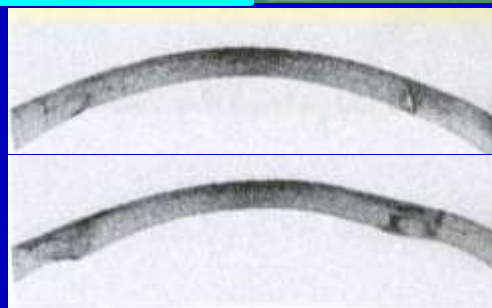
¿Which is preferable?

- Greater contact surface:

- ▶ Better sealing/healing
- ▶ Faster healing (suture removal?)
- ▶ Less astigmatism ?
- ▶ Safer in case of trauma?

- **Vertical cuts heal better than horizontal**

- Effective resistance to IOP/pulse only when “*inner spur*” configurations (zig-zag, tophat)



FsL-DALK: Results

Clinical Study

Femtosecond Laser Assisted Deep Anterior Lamellar Keratoplasty Outcomes and Healing Patterns Compared to Manual Technique

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- Manual vs. Femto-DALK comparison
- No significant differences in
 - ▶ UCVA, BSCVA @ 1m, 6m, 1^a
 - ▶ Corneal cylinder

Time	Femtosecond DALK	Manual DALK	P value
UCDVA (mean)			
1 month	0.17	0.34	0.308
6 months	0.20	0.23	0.888
1 year	0.16	0.20	0.752
BCDVA (mean)			
1 month	0.30	0.16	0.88
6 months	0.43	0.52	0.262
1 year	0.23	0.34	0.365

UCDVA: uncorrected distant visual acuity, BCDVA: best corrected distant visual acuity

TABLE 2: Analysis of corneal cylinder.

	Femtosecond DALK	Manual DALK	P value
1 month	5.36 (1.05–15.58)	5.30 (1.04–20.01)	0.873
6 months	4.80 (1.35–8.07)	4.79 (1.26–20.20)	0.467
1 year	5.43 (1.00–20.27)	4.62 (0.49–13.70)	0.280

FsL-DALK: Wound Healing



	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
M	16%	8%	64%	12%	0%
Fs	16%	8%	24%	40%	12%

- Higher grades of healing with Femto-DALK (*Mushroom*)
- Suggests more active corneal healing after femtoLaser
- Sutures might/should be removed earlier

Summary



- Keratoplasty for KC are becoming **less frequent** due to conservative treatments.
- A portion of eyes with KC **still** end up requiring a corneal transplant.
- Current trend favors **DALK**, except if full-thickness leucomas and/or breaks in Descemet M.
- **Femto**second lasers can create a complex-profiled cut that appears to heal faster/stronger, which would **allow an earlier removal of the sutures**.

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