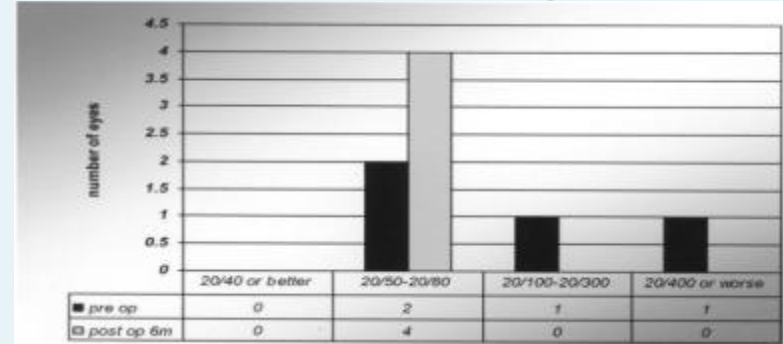
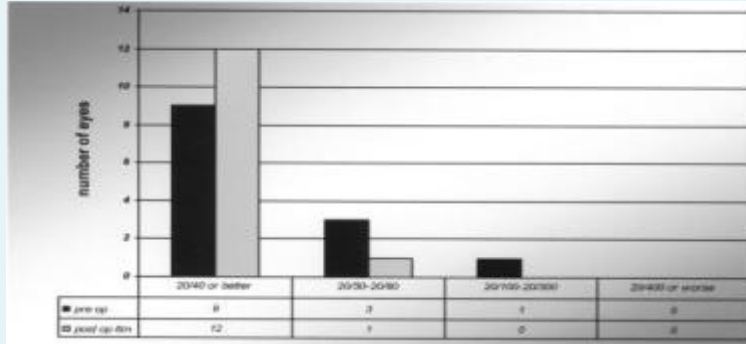


Intralamellar keratoplasty



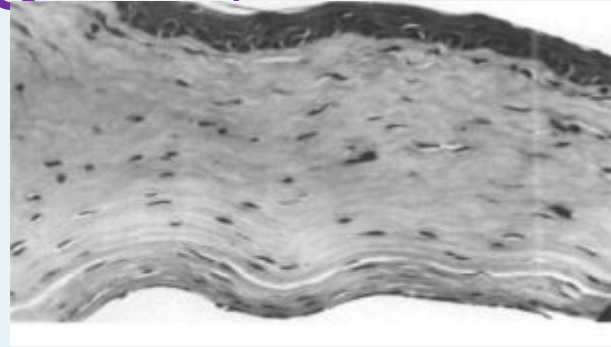
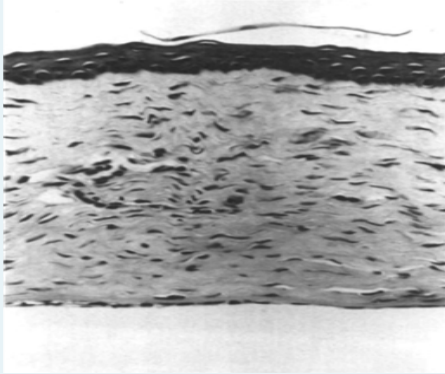
- BCVA 0.88 ± 0.34 (20/150) preop to 0.40 ± 0.09 (20/50) at 3 months and to 0.48 ± 0.06 (20/60) at 6 months postop.
- All eyes gained between 1 and 8 lines of BCVA at 6 months .
- Manifest SE -10.38 D preoperatively, to -8.82 D at 3 months, and -9.25 D at 6 months postoperatively
- Manifest refractive cylinder 3.5 D preoperatively, to 2.25 D at 3 months, and 1.68 D at 6 months postoperatively (a reduction by 1.82 D, 6 months postoperatively)

Tissue-Engineered Recombinant Human Collagen I, III

- RHC-I and -III implants can be safely and stably integrated into host corneas.
- Optical clarity was maintained in both implants RHC-III implants showed superior optical clarity
 - *Kimberley Merrett, Per Fagerholm Tissue-Engineered Recombinant Human Collagen-Based Corneal Substitutes for Implantation: Performance of Type I versus Type III Collagen IOVS. 2008;49:3887-3894*



Tissue-Engineered Recombinant Human Collagen I, III



- Over 12 months show comparably stable integration, with regeneration of corneal cells, tear film, and nerves.

Tissue-Engineered Recombinant Human Collagen I, III

- ‘Nerve regeneration in recombinant human collagen-based biosynthetic corneal grafts proceeded similarly to that in allograft tissue, demonstrating the suitability of recombinant human collagen constructs as nerve-friendly corneal substitutes. Furthermore, only minor differences were noted between type-I and -III collagen grafts, indicating an insensitivity of nerve regeneration to initial collagen type’.

» *Griffith M, Fagerholm P et al Invest Ophthalmol Vis Sci. 2008 Sep;49(9):3895-902.*



Conclusions

- Penetrating keratoplasty is no longer our first choice for surgical treatment stromal pathology
- Best-corrected visual acuity and refractive results are similar after DALK and PK.
- DALK is more technically challenging allows earlier visual rehabilitation, use of low dose steroids for shorter duration, no risk of endothelial rejection and earlier suture removal compared to PK.



Financial disclosure

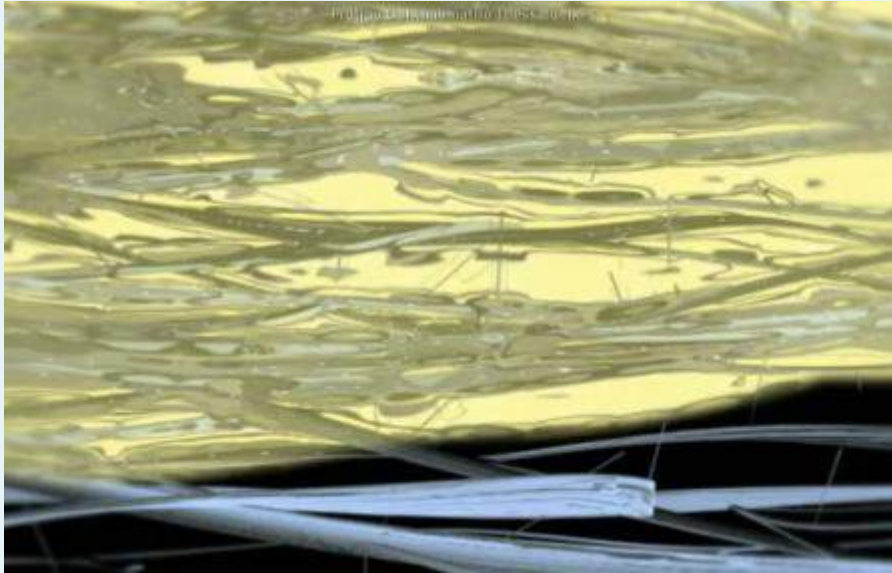
- Allergan
- Thea
- Alcon





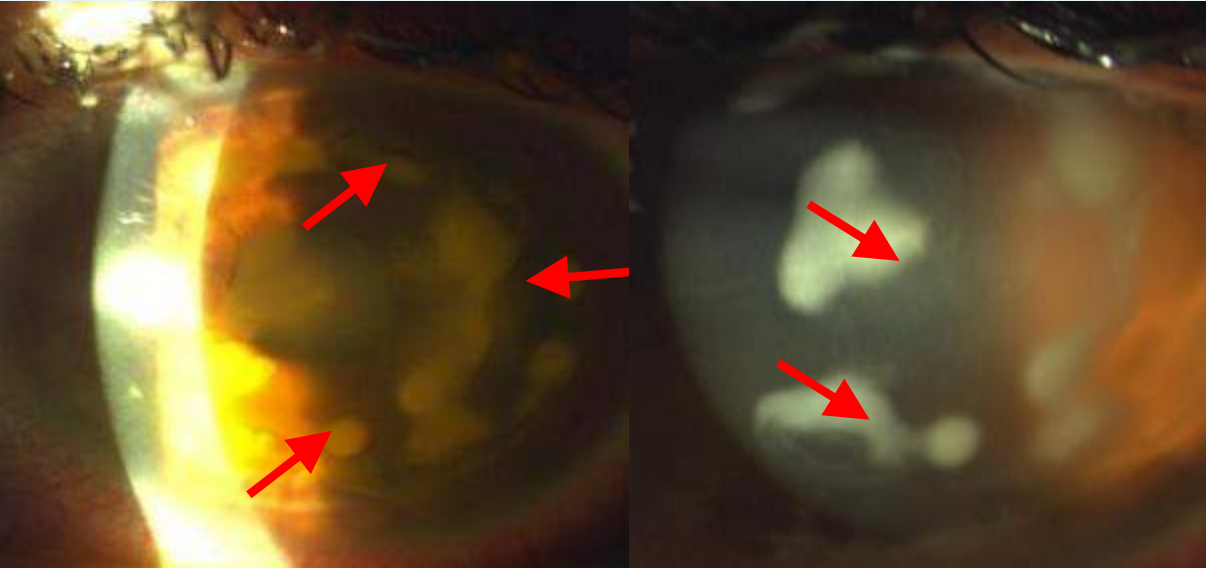
谢谢你

Intrastromal - Ideal procedure

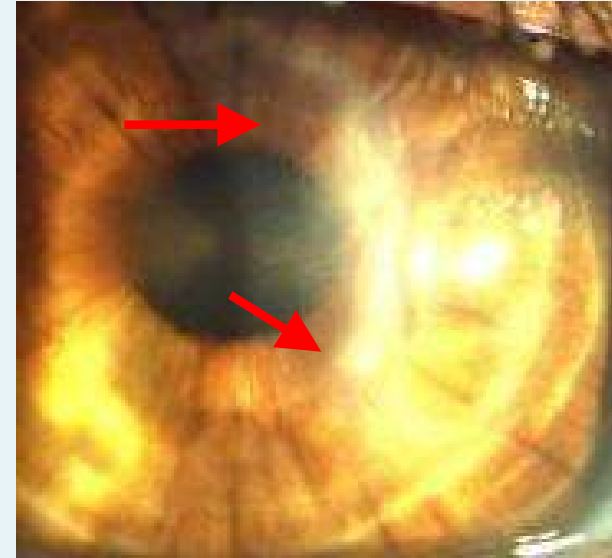


- **Safe** (fewer complications)
- **Effective**
 - UVA Transmission
 - Riboflavin Stromal saturation
- **Painless**
- Easy to perform

Fact 1:stromal opacities



‘Salzmann like’ white lesions – ‘overcrosslinking’



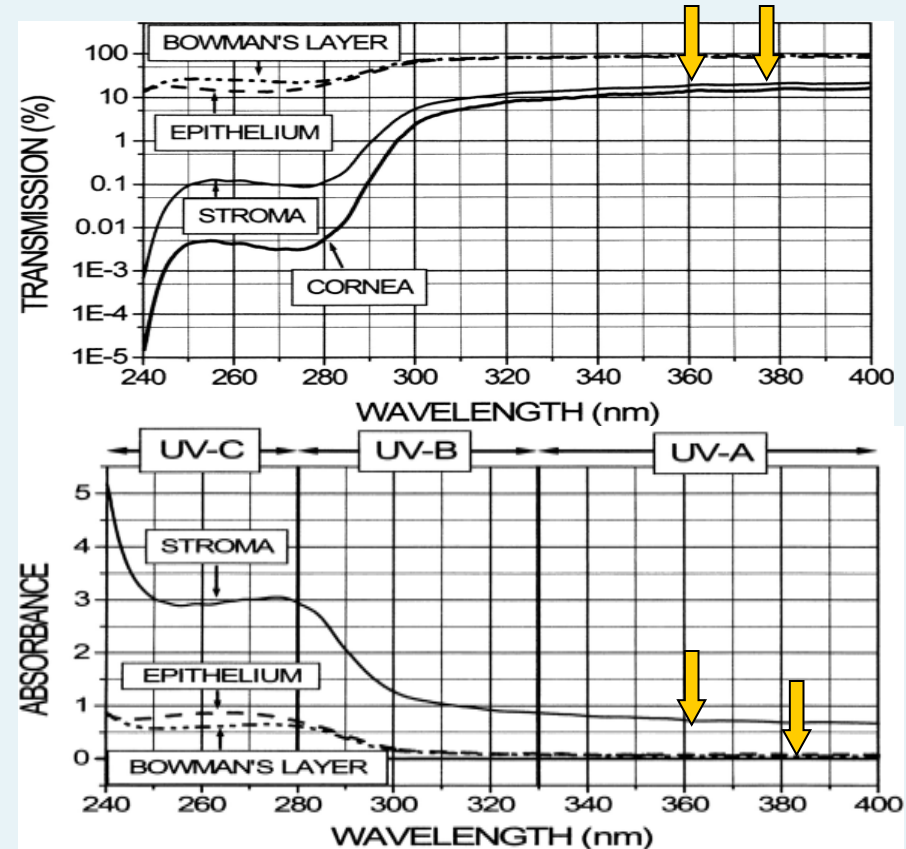
White scarring after peripheral melting

Corneal infiltrates after collagen cross linking Mangioris GF, Papadopoulou DN, Balidis MO, Poulas JL, Papadopoulos NT, Seiler T. J Refract Surg. 2010 Aug;26(8):609-11.

Fact 2 : UVA transmission / absorbance

- Corneal UVA absorbance is highest in stroma.
- Epithelium will reduce transmission by less than 10 %

– Kolozsvari et al. *UV Absorbance of the Human Cornea in the 240- to 400-nm Range IOVS, July 2002, Vol. 43, No. 7*

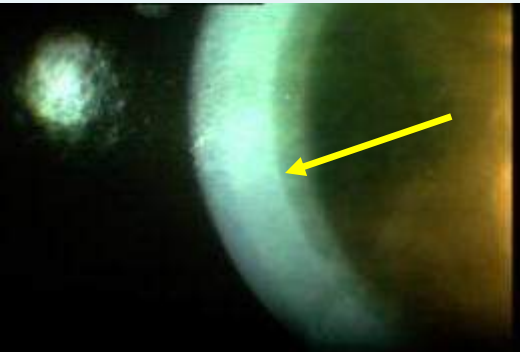
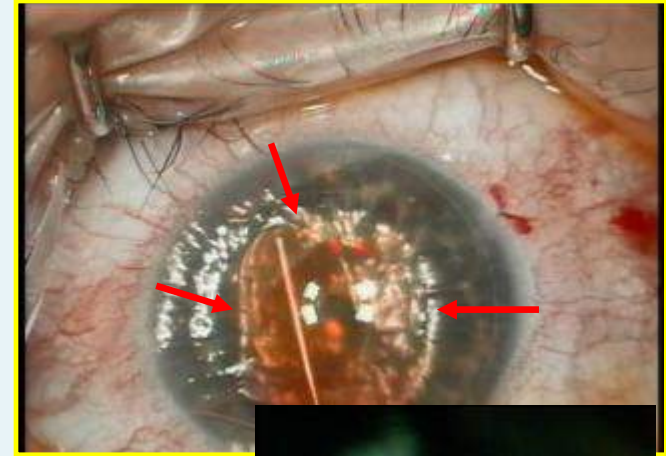
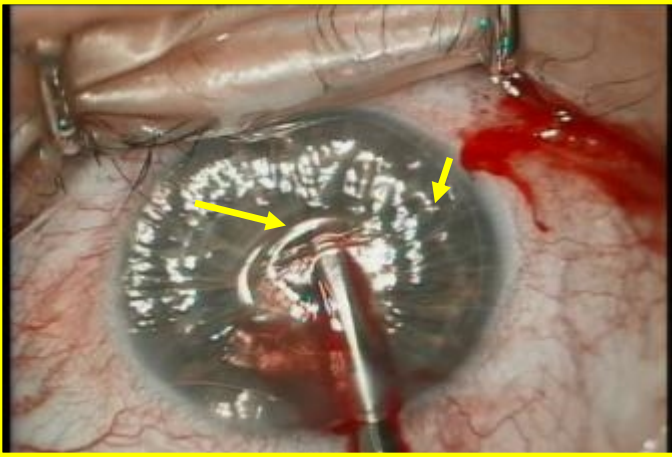


Fact 3 : Riboflavin dispersion

- After 30 min administration, the greatest concentration of Riboflavin is expected to be 55 μm from the area of injection, which in our method is 200 μm deep,.
- At the end of the procedure mean band thickness was $72.4 \pm 7.1 \mu\text{m}$.
 - *Malhotra et al In vivo imaging of riboflavin penetration during collagen cross-linking with hand-held spectral domain optical coherence tomography J Refract Surg 2012 Nov;28(11):776-80.*



First manual attempt for Intrastromal CXL



•Yellow arrow.

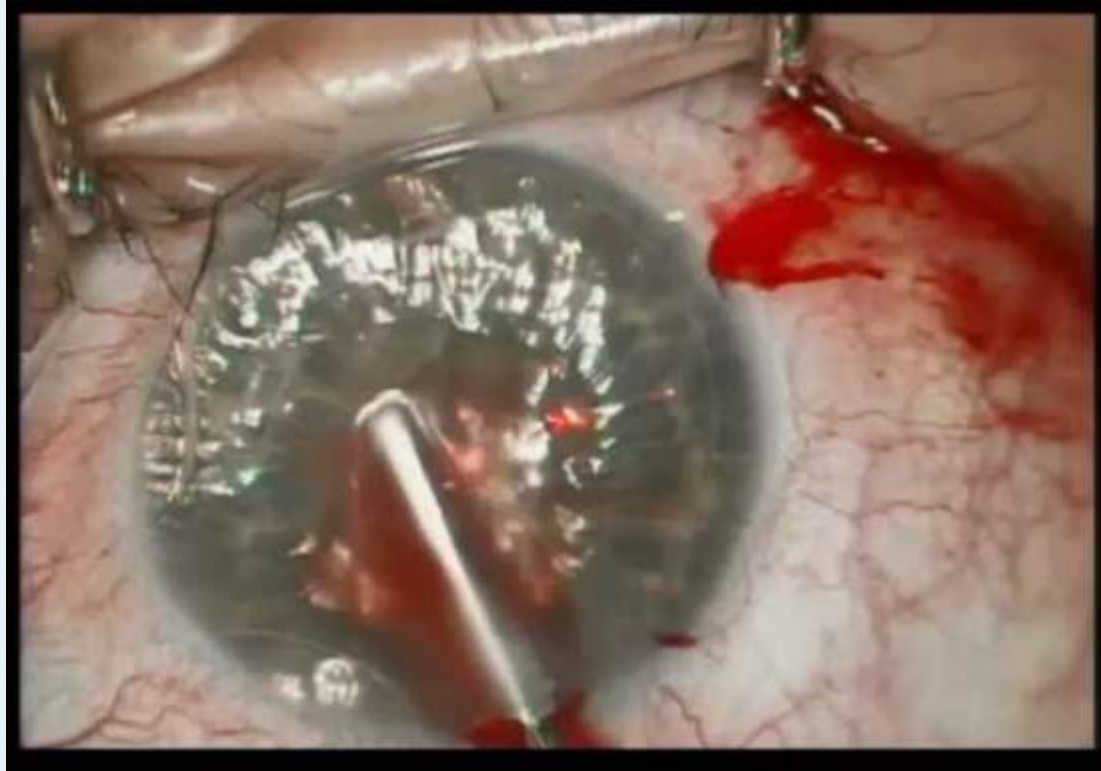
- Optical reflection Descemet's folds (upper left)
- CXL effect on deep stroma (lower)

•Red arrow (upper right)

- Riboflavin saturation



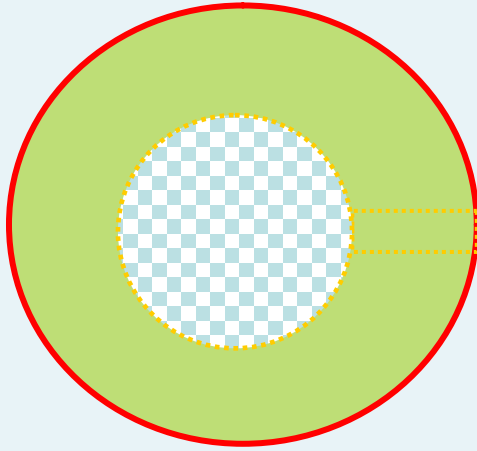
Surgical parameters



- Ring - shape intrastromal pocket at 200 μ depth. Outer diameter 6mm, inner diameter 3mm ring width 1.5 mm
- 2 opposite entry channels 0.5 x 0.5 mm
- 0.3 mL of 0.1% riboflavin in 20% dextran solution infused slowly into the pocket

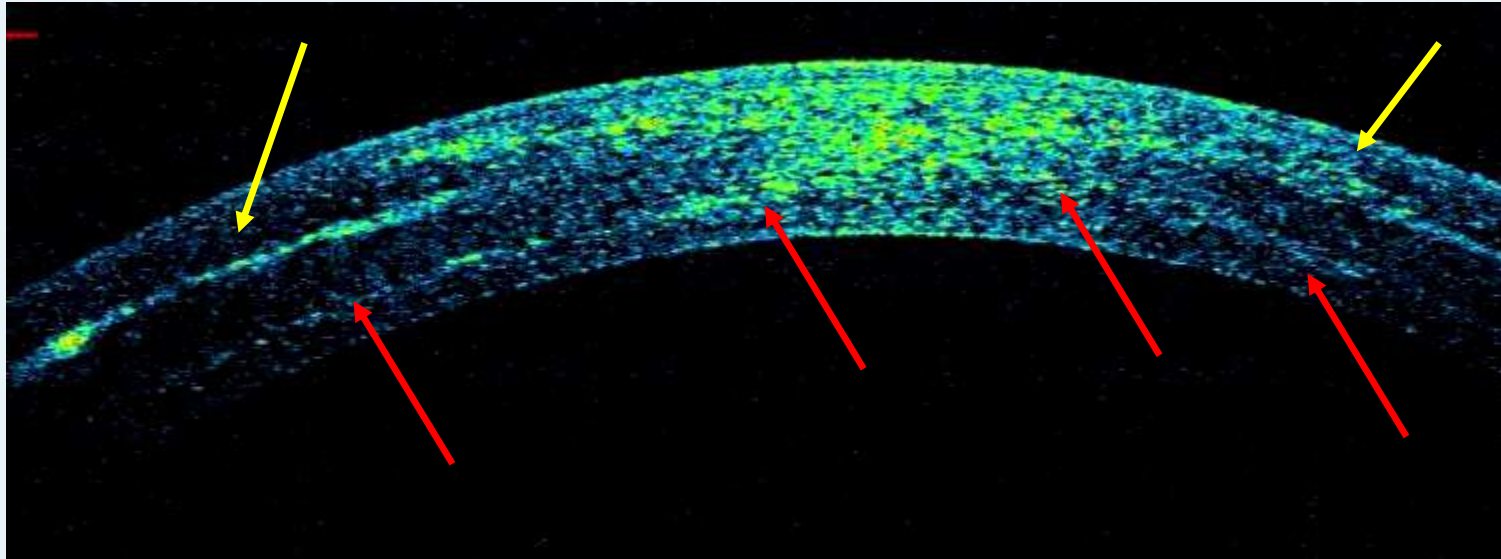
Technolas Femtec 520 Laser Wavelength 1040 nm; Pulse Rate 40 kHz; Laser Pulse Duration: 400 – 800femtoseconds ; Pulse energy 1 μ J -4mJ, distance between spots was 5 μ m

Femto-CXL

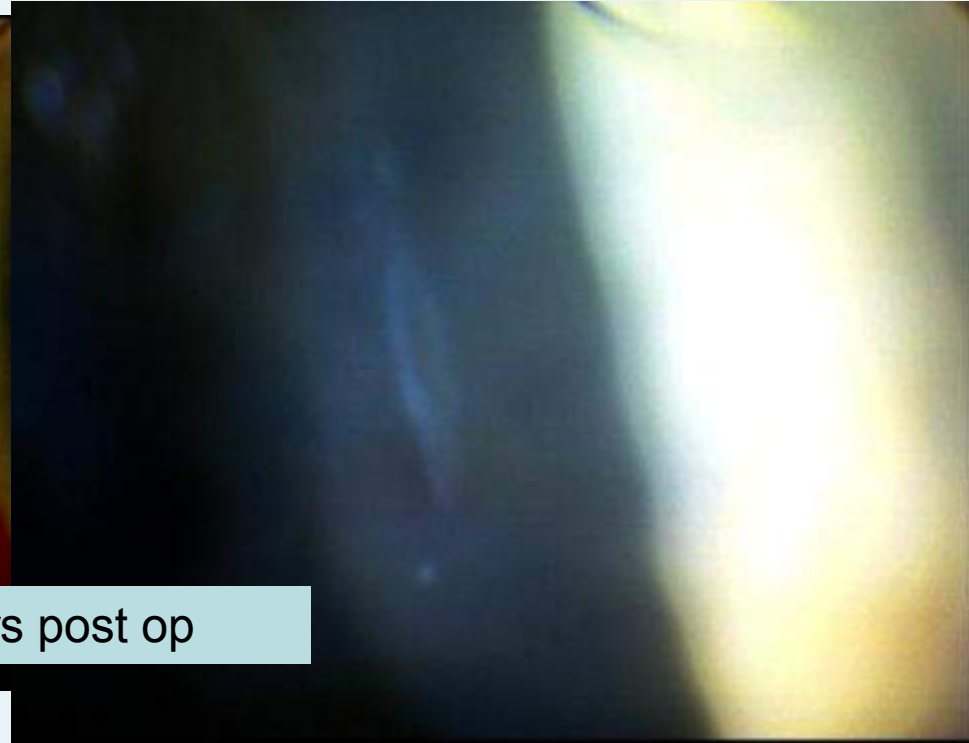
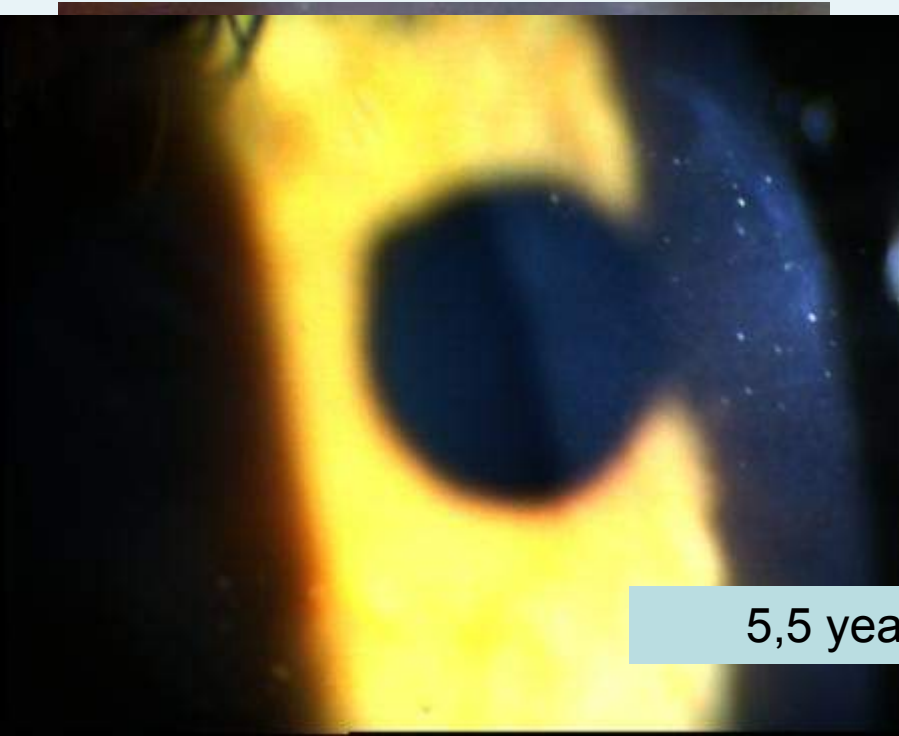


- topographic evidence of keratoconus
 - K-readings > 48 D,
 - Skewed Steepest Radial Axis (SRAX) $> 22^\circ$,
 - superior–inferior difference (S-I) on 5 mm circle > 2.5 D,
 - minimum corneal thickness > 380 μm ,
 - patient age younger than 40 years.
- 9 patients – 12 eyes with moderate keratoconus
- Mean age 31years (stdev 10years)
- 5 male – 4 female
- Pre op CVA > 0.7 decimal

Anterior segment OCT



YELLOW ARROWS FEMTO POCKET
RED ARROWS Demarcation line. Border area denuded from keratocytes



5,5 years post op

Early results

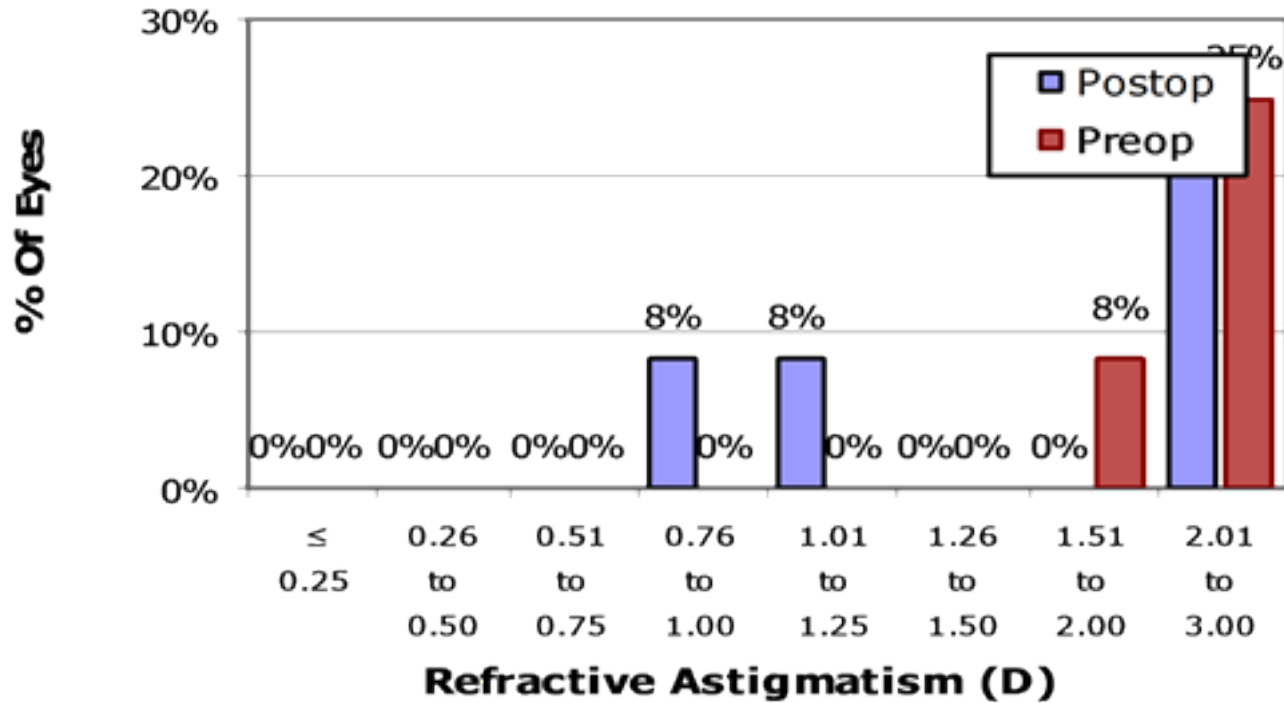
Preoperative – 6 months post op

	CVA (dec)	SPH	CYL	PACHY	CVA (dec)	SPH	CYL	PACHY
Mean	0.92	-4.13	-3.23	445.08	0.99	-3.63	-3.10	425
stdev	0.2	2.95	3.2	38.7		3.1	1.17	38.01

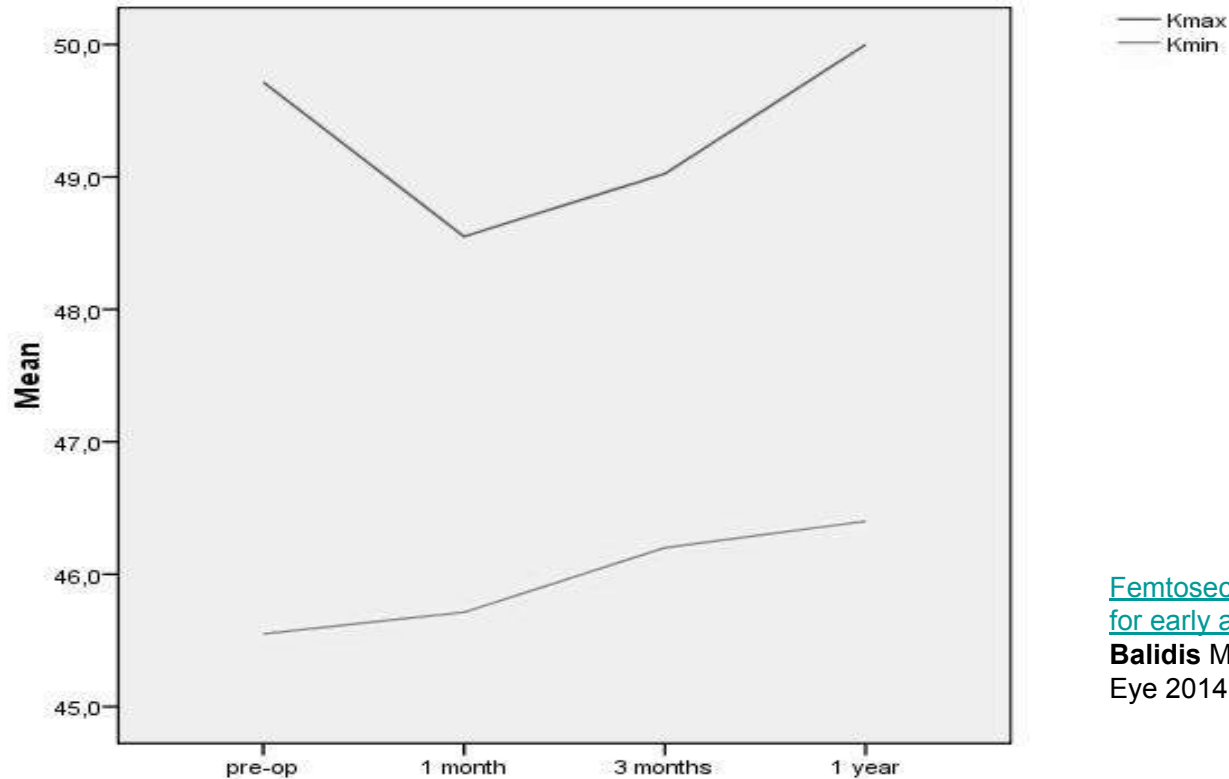


Results

1



Results



[Femtosecond-assisted intrastromal corneal cross-linking for early and moderate keratoconus.](#)

Balidis M, Konidakis VE, Ioannidis G, Kanellopoulos AJ.
Eye 2014 Oct;28(10):1258-60.

Topography - Difference maps

- K min , K max stable, mean corneal astigmatism improved
- Central flattening surrounded by midperipheral steepening, at the area of the intrastromal pocket.
- Entry incisions and pocket did not induce any astigmatic effect.
 - Prof J.Marshall demonstrate that only very deep vertical corneal incisions (80-90% ct) alter corneal curvature,



Lessons from Femto-ISCXL

Protipo Ophthalmiatrio Thessaloniki's

- Increased accuracy of CXL depth. 80-90% thickness in all cases. Better preoperative planning
- Safe, effective and painless procedure.
- Visual function improved
- Anterior stroma and pocket left for future refractive procedures

But....

Protipo Ophthalmiatrio Thessaloniki's

- Do we need to treat 80-90% of corneal thickness in all keratoconus cases?
- Can we apply a more selective treatment?
- Can we effectively treat the cone by creating a pocket at the area of the cone?