Corneal Crosslinking (CXL)

- recent advances

Theo Seiler

Institut für Refraktive und Ophthalmo-Chirurgie (IROC)
and
University of Zürich

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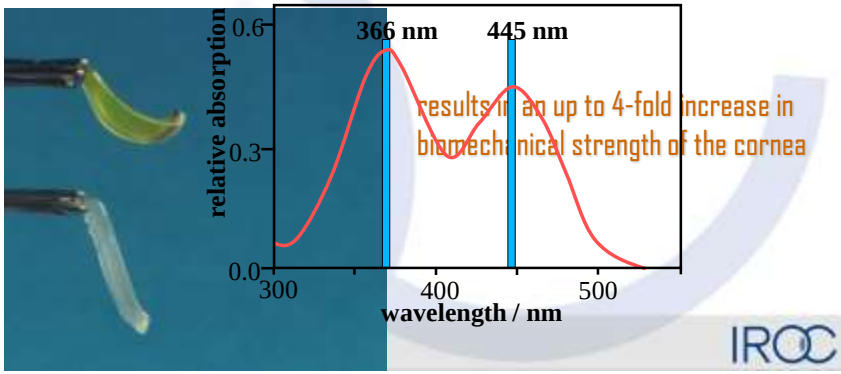
Dresden Protocol

* corneal abrasion (Ø = 9mm)

* 0.1% riboflavin in 16% dextrane for 30 min

* 3mW/cm2 at 365nm for 30min



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1. **Parameters**
   UV-light, riboflavin, oxygen
2. **Refractive CXL**

power density

The UV-lamps on the international market offer UV-irradiances ranging from 3mW/cm² to 45mW/cm²

Bunsen-law

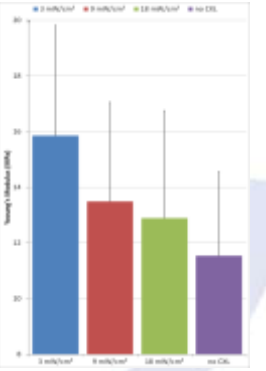
3mW/cm² + 30 min

=

9mW/cm² + 10 min

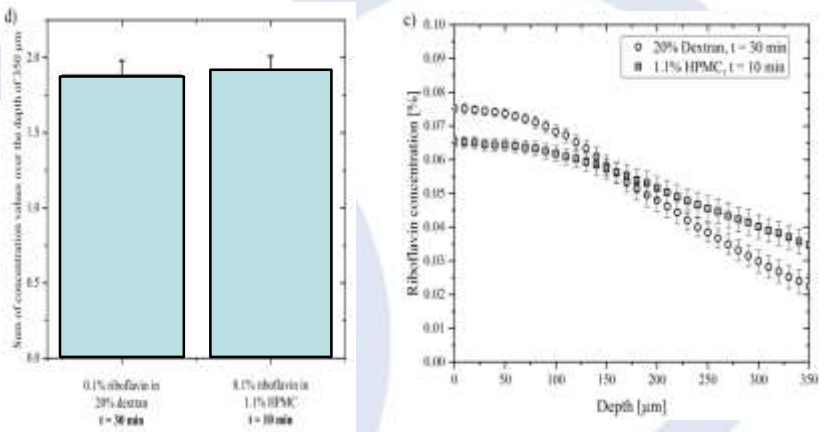
=

30mW/cm² + 3 min



Corneal biomechanical properties at different corneal collagen cross-linking (CXL) Irradiances
Arthur Hammer et al. IOVS 2014

imbibition



riboflavin gradients measured by 2-photon-microscopy

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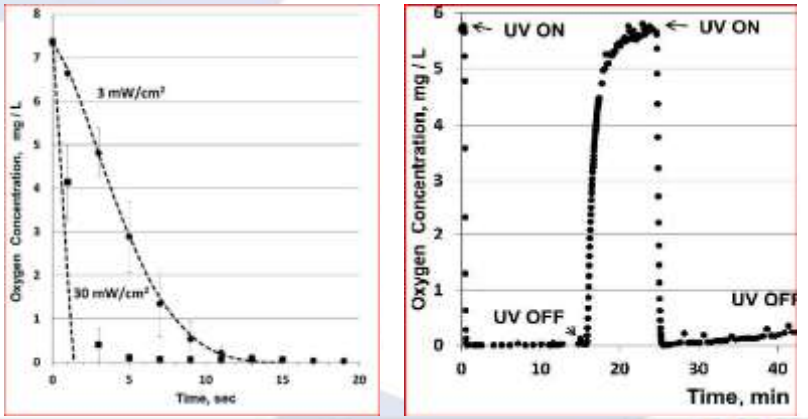
pulsed light

Seconds after UV-application oxygen is consumed and it takes minutes to let O_2 diffuse 100microns deep



Photochemical kinetics of corneal cross-linking with riboflavin
Kamaev P et al. IOVS 2012

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Conclusion 1

1. Shorter operation times may be achieved by increasing the irradiance from 3mW/cm^2 to approximately 10mW/cm^2 without significant loss of efficacy.
2. Application of riboflavin in HPMC-solution shortens imbibition time from 30 min to 10 min.
3. Switching UV-light on and off does not increase efficacy but increases treatment time.

1. Parameters
   UV-light, riboflavin, oxygen
2. Refractive CXL

Photorefractive intrastromal corneal crosslinking for the treatment of myopic refractive errors: Six-month interim findings

Results: Twenty-six eyes of 14 patients with a mean age of 30.8 years ± 9.3 (SD) were included. There were statistically significant improvements in UDVA 1, 3, and 6 months postoperatively (all $P < .001$). A significant improvement in CDVA was observed ($P = .02$). Improvements in the mean manifest sphere and MRSE versus baseline were noted at all visits ($P < .001$), with a mean change of 0.99 ± 0.47 diopter (D) and 0.97 ± 0.48 D, respectively, by 6 months postoperatively. Significant reductions in corneal curvature versus baseline occurred at all follow-up visits (all $P < .05$). At 1 month, there were no significant changes in the endothelial cell density ($P = .282$) or number of cells ($P = .069$). No safety issues or complications were reported.

Conclusion: The findings show that patterned CXL using a custom CXL system is safe and effective for reducing myopic refractive error.

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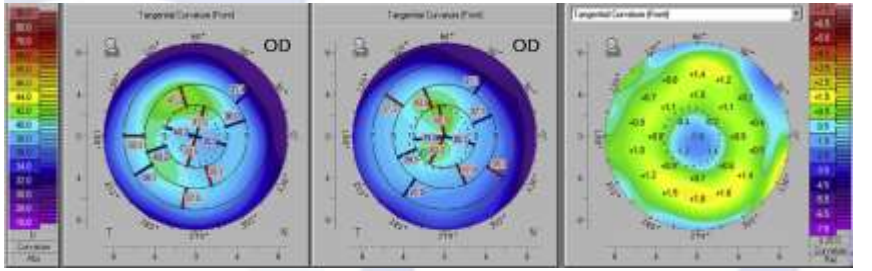

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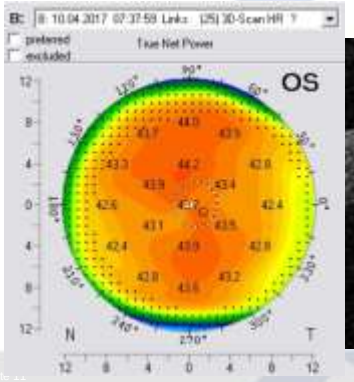
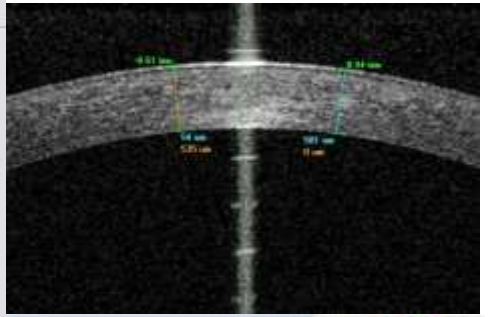
Case MG

The 25 years old patient is myopic and does not tolerate soft CL any more. Asks for simple and inexpensive alternarives.

VA OD(dominant) -0.5sph = 1.2 OS -1.0 cyl -0.5/15° = 1.1





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We decided to perform refractive epi on-CXL.

Parameters:
- **Mediocross TE 20 min**
- **oxygen 92% floating the cornea**
- **5.4 J/cm^2 , diameter 6mm, 15 mW/cm^2**

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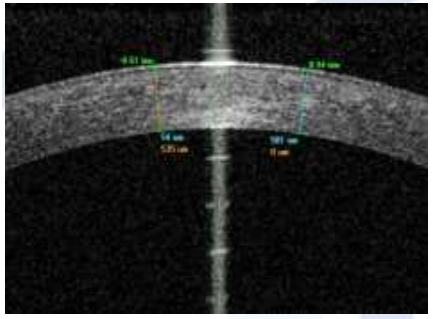
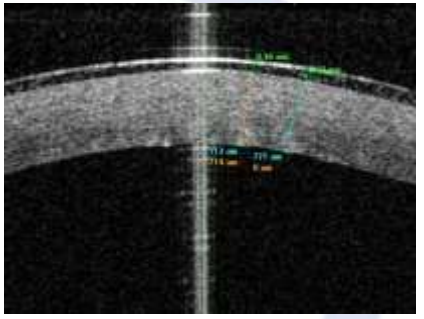
Case MG





CCT increase 200 µm (40%) **epith. thickness inc. 55 µm (100%)**

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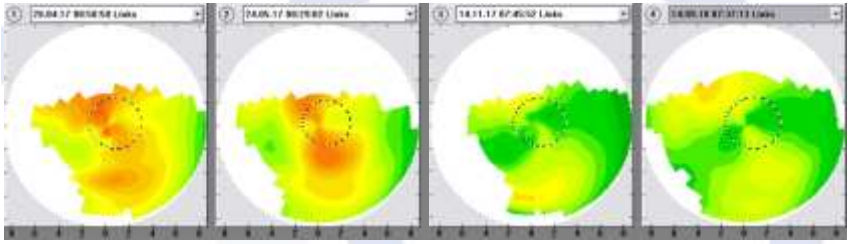

sph.equ.

-1.25D **-1.5D** **-0.5D** **-0.25D**

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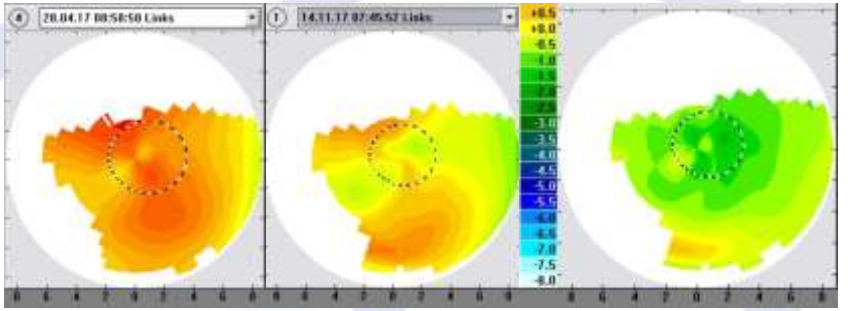
Case MG



sc 0.5 1.0p

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Conclusions

1. Shorter operation times may be achieved by increasing the irradiance from 3mW/cm^2 to approximately 10mW/cm^2 without loss of efficacy.
2. Application of riboflavin in HPMC-solution shortens imbibition time from 30 min to 10 min.
3. Switching UV-light on and off does not increase efficacy but increases treatment time.
4. Refractive CXL for myopia leaves many questions open

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