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## Corneal Haze and Scarring Post Collagen Crosslinking

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## Collagen crosslinking

- Delays or arrest progression of Keratoconus
- PACK- CXL treating corneal infection
- Failures 7.5%
- Complication? 2.9%

## Protocols

### ➤ Original Dresden Protocol

➤ 3 mW/cm<sup>2</sup> for 30 min = 5.4 J/cm<sup>2</sup>

### ➤ Accelerated protocols:

➤ 10 mW/cm<sup>2</sup> for 8 = 7.2 J/cm<sup>2</sup> (pulsed)

➤ 9 mW/cm<sup>2</sup> for 10 min = 5.4 J/cm<sup>2</sup>

➤ 18 mW/cm<sup>2</sup> for 5 min = 5.4 J/cm<sup>2</sup>

➤ 30 mW/cm<sup>2</sup> for 3 min = 5.4 J/cm<sup>2</sup>

## Bunsen-Roscoe law (BRL)

*“A certain biological effect is directly proportional to the total energy dose irrespective of the administered regime”*



## CXL was performed by (Avedro KXL® system, Waltham, MA, USA) with 2 different accelerated protocols

### Protocol 1

- 21 eyes (14 males, 7 females) with mean age of 26.43 years
- CXL performed with pulsed 8 minutes at 30 mW/cm<sup>2</sup> ultraviolet irradiation
- Total UV irradiation of **7.2 J/cm<sup>2</sup>**

### Protocol 2

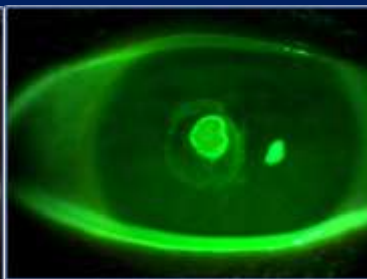
- 28 eyes (22 males, 6 females) with mean age of 28.75 years
- CXL performed with continuous 12 minutes 10 mW/cm<sup>2</sup> ultraviolet irradiation
- Total UV irradiation of **7.2 J/cm<sup>2</sup>**

## Results:

- **Protocol 1:** 4/21 patients developed localized dense haze, 2 of which had epithelial defect overlying the haze. Visual acuity dropped initially in the 4 patient but at 6 months post-operative BCVA returned to the preoperative level.
- **Protocol 2:** No patients had complications

## Retrospective analysis of:

- preoperative parameters
- Age, sex
- Kmax, K1, K2, Km, thinnest pachymetry
- cylinder and spherical equivalent



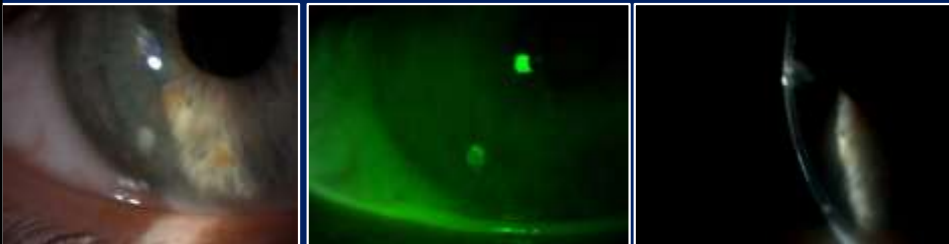
Case number  
1: Paracentral  
epithelial  
defect with  
deep haze. VA  
drops from  
6/9 to 6/18

6 months post-op: the haze  
was much fainter with  
return of BCVA to 6/9





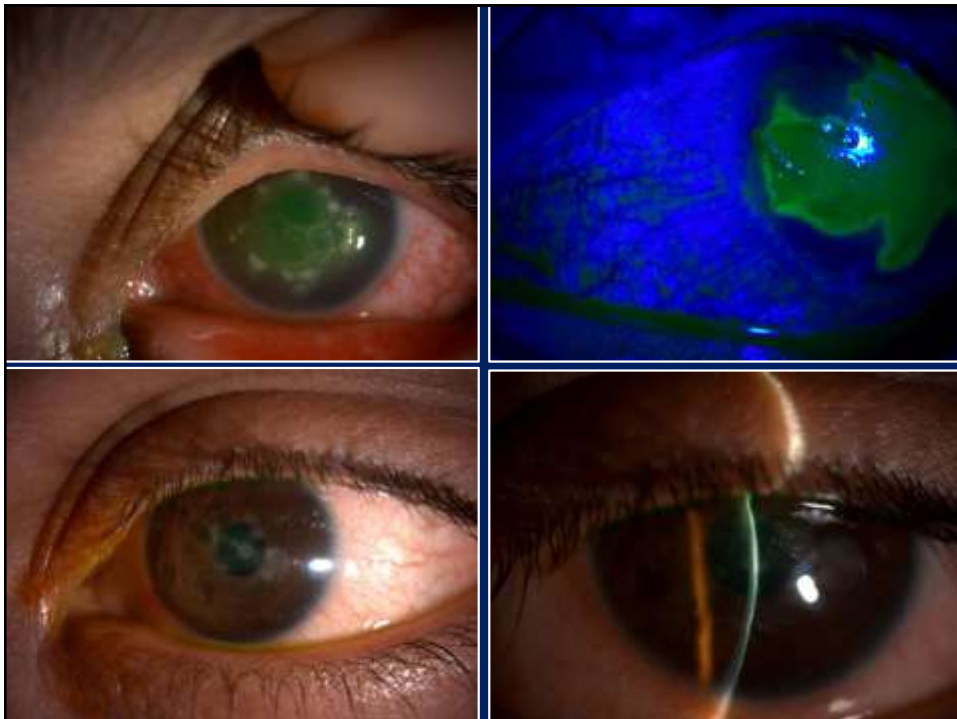
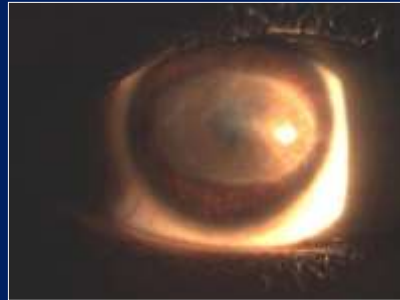
Case number 2: (Left) patient developed central ill defined haze with epithelial defect, his BCVA dropped from 6/7.5 pre-operative to 6/24. (Right) At 6 months post-operative his BCVA was 6/7.5 and he was left with a central, more faint and less defined corneal scar



Patient number 3: Peripheral corneal localized haze (left) with epithelial defect (Middle) at the junction of treated and untreated area. BCVA dropped from 6/18 to 6/60. At 6 months post-operative his BCVA was 6/18 with CL, a faint superficial scar was still remaining (right).

## Infection post CXL

- Incidence of 17/10000
- Epithelial debridement removes the protective barrier
- UV irradiation can lead to HSK reactivation



## Conclusions

- UVA, used over short intervals could potentially be associated with higher tissue damage
- The BRL would be applicable to biological tissues only within defined limits
- Randomized control trials are required to ascertain the advantage of saving time outweighs the potential risk to safety
- Infection post CXL is a rare but potentially devastating complication