Accelerated corneal cross-linking with photoactivated chromophore (PACK-CXL) for moderate therapy-resistant infectious keratitis

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• FH: holds a patent on a UV light source
• All others: none
The problem in corneal infections are multiple.

- Diagnostic dilemma
- Therapeutic dilemma
  - Choice of appropriate Ab. therapy
  - Resistance of pathogen to Ab. drugs
  - Period of Ab. treatment
- Socio-Economic
- Economic consideration

Keratitis
Summary of PACK-CXL in the literature.

190 cases

174 cases: additional treatment
17 cases: solo-therapy¹²

189 cases
Standard “Dresden” protocol

Only 1 case was treated with accelerated PACK-CXL²

2. Tabibian D. Accelerated PACK-CXL as a First-line and Sole Treatment in Early Fungal Keratitis. JRS. 2014: 30:855-857
Accelerated PACK-CXL?

- Accelerated UVA irradiation at 365 nm and 9 mW/cm² for 10 minutes was reported in a single case report by Tabibian in 2014 as a successful first-line and sole treatment in early fungal keratitis.
Richotz O., Hafezi F. Antibacterial efficacy of accelerated corneal cross-linking with photoactivated chromophore (PACK-CXL).

To evaluate the effect of accelerated PACK-CXL (corneal cross-linking with photoactivated chromophore) as an additional treatment for therapy-resistant infectious keratitis.
Patients and Methods


**Inclusion criteria:**
- Corneal ulcer of suspected bacterial origin >2mm
- No response to conventional Ab. treatment (Vancomycin + Fortum)
- Signed informed consent

**Exclusion criteria:**
- Pregnancy or breast feeding
- Descemetocele
- Corneal perforation
- Suspicion of non-infectious keratitis
- Endophtalmitis

**Treatment endpoints:**
- Final UDCVA
- Day of re-epithalization
- Rate of emergency PKP
UV-A radiation
(30mW/cm²
For 3 min,
Lightmed Ltd.)

Medio-cross hypo-osmolaric 0.1%, riboflavin (each 2 min for 20 min)

Corneal scraping for culture

Abrasion of epithelium. (1mm around the borders)

Rinsing and patching with Ab. ointment
Results

Twenty eyes from 20 patients (11 males/9 females) with an average age of 54.5 ± 27.9 years have been included in study.

- The initial mean ulcer diameter was 3.5 ± 1.3mm.
- Five patients (25%) presented with a hypopyon on admission to our department.

The pathogens were identified in 12 (60%) patients of study population.
Results

- Initial UDVA was 2.1±0.96 (HM) and finally UCVA 1.26±0.83 (6/120m).

- The mean duration to complete re-epithelization was 11.3 ± 7.7 days.
Surgical treatment after PACK-CXL

- Emergency PKP: 5%
- [CATEGORY] NAME: 95%

64 y.o. patient with a Proteus Mirabilis and Candida Parapsilosis corneal abscess.
Accelerated PACK-CXL in Gram (+)

- *Staphylococcus epidermidis.*

before PACK-CXL

S/P 5 Days

S/P 2 weeks

Initial UDVA 6/60

Final UDVA 6/15
Pre and Post accelerated PACK-CXL in Gram (-)

*Klebsiella pneumoniae, Pseudomonas Aeruginosa and Serratia Morganella*

Before PACK-CXL

S/P 3 Days

S/P 2 weeks

initial UCVA= CF 1 m

final UCVA= 6/24
Accelerated PACK-CXL in Gram (-)

*Klebsiella Pneumonia*

Before PACK

Initial UCVA=HM

S/P 3 weeks

Final UCVA = 6/60
# Effects of PACK-CXL in Infective Keratitis

**Cornea**

1. Increase the biomechanical strength of cornea
2. Stabilize and increase response of cornea to digestive enzymes of pathogens.

**Microorganism**

3. Intercalation of the chromophore (riboflavin) with the nucleic acids of the pathogen and inhibition of replication.
4. Damage to the pathogen’s cell walls caused by massive amounts of ROS.
Conclusion.

• *This is the first study that shows the promising results of therapy with accelerated PACK-CXL protocol.*

• Our results suggest that accelerated PACK-CXL may provide an antimicrobial effect similar to the low intensity slow settings (30 min @ 3 mW/cm²), and may be used as an additional treatment in moderate-sized therapy-resistant infectious keratitis.

• Further research is needed to show the beneficial effect of this accelerated treatment for infective keratitis.
Thank you