PACK-CXL for infectious keratitis

Schwind User Meeting 2014

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Financial disclosure

- Patent application: PCT/CH2012/0000090
- Patent application: PCT/CH2014/0003786
New indication: Corneal ulcers

USA

- Contact-lens wear
- 60,000 new cases / year

India

- Minor trauma
- > 2 million new cases / year
- “Silent epidemic”, Leading cause of global blindness (WHO)

- State of the art: medication
- Diagnostic / therapeutic dilemma
- Expensive treatment
- Increasing resistance to antibiotics
PACK-CXL

Photo

Activated

Chromophore for

Keratitis
1. Intercalation with DNA

2. Reactive oxygen species

3. Changes in tertiary structure = steric hindrance

PACK = disinfectant
PACK-CXL

Pot and Hafezi, Vet Ophthalmol, 2013
• Reduction of Staph aureus by 97% in **30 minutes** (Dresden keratoconus protocol)

**Figure 1.** Percent of growth inhibition of organisms with exposure to riboflavin, ultraviolet (UV) light, or combined riboflavin and UV light.

*Schrier et al., IOVS, 2008*

*Martins et al., IOVS, 2008*
No antibiotics

Before PACK-CXL

Two weeks after PACK-CXL

Makdoumi et al., 2011
Iseli et al, 2008
2014: Advanced ulcers

- Prospective randomised clinical study
- 40 patients with therapy-resistant end-stage ulcer
- Bacterial, fungal, mixed
- Arm 1: Medication only, 21 patients
  Arm 2: Medication plus CXL, 19 patients
- Healing time comparable, complications in
  - Medication only: 21%
  - Medication plus CXL: 0%

Healing within 14 days

Said and Hafezi, Ophthalmology, 2014
When is PACK-CXL most beneficial?

Infiltrate / Early ulcer?

Advanced ulcer?

PACK-CXL Study Group
(Prospective, randomised multicenter trial, 14 sites)
The future
Think globally - treat early
Current state vs Unmet needs

Expensive
Sterile infrastructure
Slow (30 min)
Bulky devices
No security mechanisms
Performed by specialists

Inexpensive
Doctor’s office
Fast (2.5 min)
Small devices
Security mechanisms
General ophthalmologist
Own research 2010-2014

1. Accelerate treatment
2. Use basic infrastructure
3. Include safety mechanism
CXL  Keratoconus

Hammer et al, IOVS 2014

• Significant decrease at 9 mW/cm²
• Intensity-dependent

1 Accelerate treatment

n=50
PACK-CXL | Ulcer

Richoz et al, submitted

- Same efficacy at high intensities
- Intensity-independent
- Different pathways for CXL and PACK-CXL?

New chromophore (not riboflavin)

- 99.9% of MRSA in 120 seconds
2 Use basic infrastructure
2 Work at the slit lamp

C-Eye© device

www.emagine-eye.com
2 Work at the slit lamp

- **Consumable tip**

- **Beam optimization**
  - *Keratoconus*
  - *Corneal Ulcer*

- **Intensities delivered**
  - 3 mW/cm²
  - 9 mW/cm²
  - 18 mW/cm²
  - 30 mW/cm²

- **HD camera**
  - Videos & still images

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3 Safety mechanism

• Real-time measurement of riboflavin fluorescence
• Device stops treatment if insufficient

www.emagine-eye.com