Transepithelial corneal cross-linking using an enhanced riboflavin solution

Frederik Raiskup

Dept. of Ophthalmology, C.G. Carus University Hospital Dresden, Germany
Chairman: Prof. L.E. Pillunat, MD
Transepithelial CXL

► intact epithelium = barrier for riboflavin

• pharmacological cleavage of tight-junctions with
  – BAC, chlorobutanol, EDTA, gentamicin, tetracaine

• intrastromal application of riboflavin (pockets)

• injection of riboflavin into the stroma (needles)

• iontophoresis
Transepithelial CXL

• „…Safety would be enhanced with a transepithelial procedure that keeps the epithelial barrier function intact and avoids wound-response reactions in the stroma….“:
  • persistent epithelial defects
  • melting processes
  • infections
  • developing of permanent stromal scars

Transepithelial CXL

• „…designed to avoid the early postoperative pain and temporary worsening of vision…“

Transepithelial CXL

Transepithelial CXL

• prospective, interventional multicenter cohort study
• 26 eyes of 26 patients
• 16 ♂, 10 ♀
• Age: 27.6±6.4y.
• F/U: 12m.
• proparacaine 0.5% drops instilled 5 min. before the procedure
• modified riboflavin solution instilled every minute for 30 min.
• pachymetry
• CXL: 9mW/cm² for 10 min.
Transepithelial Corneal Cross-linking Using an Enhanced Riboflavin Solution

Zisis Gatziofias, MD, PhD; Frederik Raisskup, MD, PhD, FEBO; David O’Brart, FRCS, FRCOphth, MD; Eberhard Spoerl, PhD; Georgios D. Panos, MD(Res); Farhad Hafezi, MD, PhD
postop. epithelial defects in 46%
marked SPK´s or loose epithelium 23%
failure in 46% ( increase > 1,0 D in Kmax at 12 m. after TE-CXL)
no infection, sterile infiltrates, haze
Transepithelial CXL: Literature

• Filippello M, Stagni E, O´Brart D. JCRS 2012: „…appeared to halt keratoconus progression, with a statistically significant improvement in visual acuity and topographic parameters“ cohort study

• Lesniak SP, Hersh PS. JCRS 2016: „…statistically significant improvement in maximum K values and CDVA at the 6-month follow-up.“ prospective clinical trial

• Leccisotti A, Islam T. JRS 2010: „A limited but favorable effect … The effect appears to be less pronounced than …CXL with de-epithelialization.“ prospective, consecutive study

• Koppen C, Wouters K, Mathysen D et al. JCRS 2012: „Transepithelial CXL …less effective than standard CXL…“ cohort study
Transepithelial CXL: Literature

- Caporossi A, Mazzotta C, Paradiso AL et al. JCRS 2013: "Functional results after TE-CXL showed keratoconus instability, in particular in pediatric patients...“ prospective case series

- Kocak I, Aydin A, Kaya F et al. JFO 2014: "...TE-CXL does not effectively halt the progression of keratoconus...“ prospective case series
Transepithelial CXL: Literature


- Caporossi A, Mazzotta C, Baiocchi S et al. EJO 2012: "… TE-CXL showed a limited apoptotic effect…, about one-third of classic epi-off…"

- Mastropasqua L, Nubile M, Lanzini M et al. Cornea 2013: "…marked corneal modification, which were poorly evident in the TE-CXL…"
Transepithelial CXL

• Methods: Gentamicin, BAC, EDTA were instilled for 3 hours, then oxybuprocaine for 30 min. Riboflavin 0.1% in 20% dextran T500 and oxybuprocaine were instilled for 30 min. Finally, UVA irradiation to the central 7.5mm of the cornea was applied for 30 min, while riboflavin was instilled every 5 min. “
Transepithelial CXL: Future?

- Bottos KM, Oliveira AG, Bersanetti PA et al. PLoS ONE 2013 8(6): “Riboflavin nanoemulsion was able to penetrate the corneal epithelium…“

29-y. ♂ CDVA (CL)=0,8

- 12/2008: LE CXL standard protocol:
  $K_{\text{apex}}$: 72,58D → 62,38D
- $K_{\text{apex}}$: 60,2D → 61,5D
- 01/2014: LE TE-CXL (CT 380μm)
  $K_{\text{apex}}$: 60,5D
- $K_{\text{apex}}$: 64,3D
- 11/2016: LE CXL (CT 377μm, Ø epithelium 338μm, after hypoosmolar solution 493μm)
3 weeks after TE-CXL:
AS OCT
Transepithelial CXL

no dextran, hypoosomolar solution, 0.01 %BAC