

Corneal Collagen Crosslinking with Hypo-Osmolar Riboflavin Solution Versus Transepithelial Crosslinking for Keratoconus With Thin Corneas

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PURPOSE

To compare efficiency and safety of corneal collagen cross-linking with hypo-osmolar riboflavin solution (HyCXL) versus transepithelial cross-linking (TE-CXL) for progressive keratoconus with thin corneas.

METHODS

Patients with progressive keratoconus and a corneal thickness (CT) less than 400 μm (without epithelium) were in the HyCXL group. After the epithelium was removed, hypoosmolar solution was applied for 30 minutes and pachymetric measurements were taken. If corneal thickness became more than 400 μm , the cross-linking procedure was started. In the TE-CXL group corneal thickness was between 400 and 450 μm . Uncorrected distance visual acuities (UDVA) and corrected distance visual acuities (CDVA), biomicroscopic findings, intraocular pressure measurements, fundoscopic findings, pachymetric measurements and corneal topography parameters were recorded for each patient. There were 14 patients, 20 eyes; (mean age, 17.50 ± 2.4 years) in the HyCXL group and 12 patients, 18 eyes; (mean age, 17 ± 3.2 years) in the TE-CXL group. Statistical analysis was performed using SPSS for Windows (version 21.0, SPSS Inc., Chicago, IL).

RESULTS

In the HyCXL group improvement at month 9 was present for Kmax [-1.21 diopters (D), $P = 0.01$], Kmin (-1.42 D, $P = 0.01$) and mean K (-1.35 D, $P = 0.01$). The difference between preoperative-postoperative UDVA ($p=0.24$) and preoperative-postoperative CDVA was not significant ($p=0.38$). Postoperative corneal edema lasted 1 month in 10 eyes (50%) and more than 3 months in 1 eyes (5%). In the TE-CXL group improvement at month 9 was present for Kmax (-1.18 D, $P = 0.01$), Kmin (-1.54 D, $P = 0.01$) and mean K (-1.33 D, $P = 0.01$). The difference between preoperative-postoperative UDVA ($p=0.22$) and preoperative-postoperative CDVA was not significant ($p=0.34$). No postoperative corneal edema after TE-CXL was observed. Changes at month 9 from baseline were not significantly different between the 2 groups ($P = 0.15$). Mean postoperative pain was significantly higher in the HyCXL group than in the TE-CXL group on the day of the surgery and on the first postoperative day. No significant differences were noted during the following 3 days.

DISCUSSION

Hafezi et al. suggested a modification of the standard treatment protocol that includes practice of hypoosmolar riboflavin solution in thin corneas to reach at least 400 μm of corneal thickness and then the practice of cross-linking treatment safely to cornea having stromal thickness above threshold level. They implemented this protocol to 20 patients and reported stabilization of keratectasia in 12 patients and regression in eight patients. They did not report any treatment complications. TE-CXL in 20 patients with bilateral progressive keratoconus using enhanced riboflavin solution was undertaken by Filippello et al. They reported a statistically significant improvement in visual and topographic parameters and determined that the treatment appeared to stop keratoconus progression.

CONCLUSIONS

In thin corneas with progressive keratoconus, transepithelial cross-linking was less painful, provided similar effectiveness and fewer complications than cross-linking with hypotonic riboflavin solution at 9-month follow-up.

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