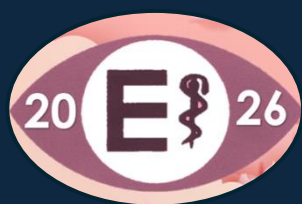


# Early Corneal Healing Responses Following Corneal Collagen Crosslinking in Keratoconic Eyes with Comorbidities



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**AIM:** To evaluate the impact of preoperative ocular surface inflammatory comorbidities on epithelial healing following epithelium-off corneal collagen crosslinking (CXL) in keratoconus.

**METHODS:** This retrospective study included 147 eyes of 104 patients with progressive keratoconus undergoing epithelium-off corneal collagen crosslinking (CXL). Fifty-five eyes had ocular surface inflammatory disease, while 92 eyes without comorbidities served as controls. Eyes with ocular surface disease received appropriate preoperative treatment to optimize the ocular surface. Preoperative evaluation included BUT, NIBUT, Schirmer test, corneal staining, OSDI, and meibography. Postoperative epithelial closure time and corneal haze were assessed. Group comparisons were performed using nonparametric and chi-square tests.

**RESULTS:** Ocular inflammatory disease was present in 37.4%. Among eyes with ocular surface disease, allergic conjunctivitis was present in 41.8%, vernal keratoconjunctivitis in 30.9%, meibomian gland disease in 14.5%, and atopic conjunctivitis in 12.7%. Postoperatively, corneal haze gradings did not significantly differ between groups. However, delayed epithelial healing (>3 days) was significantly more common in eyes with ocular surface disease ( $p=0.011$ ). This difference was primarily driven by the VKC subgroup (41.2% vs 9.8% in controls,  $p=0.021$ ), while other subgroups showed no significant differences compared to controls.

Table. Delayed Epithelial Healing (>3 days) After CXL Across Ocular Surface Subgroups

Group	Eyes (n)	Delayed epithelial closure n (%)
Control	92	9 (9.8%)
Ocular surface disease	55	14 (25.4%)
○ Allergic conjunctivitis	23	5 (21.7%)
○ <b><i>Vernal keratoconjunctivitis</i></b>	<b>17</b>	<b>7 (41.2%)</b>
○ Atopic conjunctivitis	7	1 (14.3%)
○ Meibomian gland disease	8	1 (12.5%)

**DISCUSSION:** Epithelial healing after CXL is generally rapid and complete in a few days (Caporossi et al., 2010). In our study, epithelial closure was statistically significantly delayed in VKC, compared to controls, apparently due to the chronic inflammatory process and corneal epithelial alterations characteristic of this condition (Bruschi et al., 2023; Albadawi et al., 2023).

**CONCLUSION:** Preoperative ocular surface inflammation, particularly vernal keratoconjunctivitis, is associated with longer epithelial recovery after corneal collagen cross-linking despite pre-operative ocular surface optimization. Careful assessment and management of any ocular surface before CXL improves postoperative outcomes.

In keratoconus patients, among co-existing ocular surface diseases, only VKC is associated with delayed epithelial healing after CXL despite pre-operative treatment, while corneal haze remains unaffected.