

Introduction

Keratoconus (KC) is a common degenerative disorder characterized by progressive thinning and biomechanical weakening of the cornea leading to irregular astigmatism, myopia, and visual loss. Photochemical corneal collagen cross-linking (CXL) is the gold standard for treatment of KC and has been shown to strengthen corneal biomechanical stability but provides little to no visual improvement¹. Combining corneal CXL with refractive surgery can address the underlying pathophysiology of KC and resurface the cornea to improve functional vision.

Background

- While the exact etiology is unknown, KC is characterized by progressive bilateral, asymmetric, noninflammatory corneal thinning²
- As KC progresses, refractive lenses often fail to provide useful vision and is one of the most common indications for corneal transplantation³
- In 2016, the FDA approved corneal CXL induced by UV-A irradiation and photosensitizer riboflavin which has been shown to halt the progression of KC⁴
- This study evaluated the safety and efficacy of combining corneal CXL with refractive surgery in keratoconic eyes



Image 1: A normal cornea (left) compared to one with KC (right)⁵

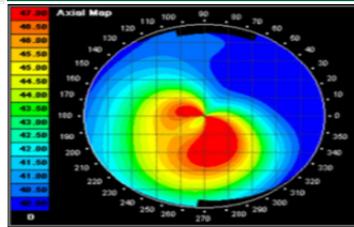


Image 2: Abnormal Topography of eye with KC⁶

Methods

Patient population

- We conducted a single-site retrospective study of 41 keratotic eyes treated at an outpatient ambulatory surgery clinic
- All patients were preoperatively examined at baseline and at 12-months post-op
- 20 eyes underwent simultaneous corneal CXL combined with LASEK (CXL-LASEK Group)
- 21 matched controls underwent CXL only (CXL-only Group)

Measures (preop and 12-months postop)

- Corneal stability was assessed with topography and keratometry
- Visual acuity was assessed Best Corrected Visual Acuity (BCVA) and spherical equivalent

Surgical Technique

- Photochemical corneal CXL with UV-A exposure (Image 3)
- Refractive correction with Laser Assisted Sub-Epithelial Keratectomy or LASEK (Image 4)

Image 3: Photochemical corneal CXL with photosensitizer riboflavin and UV-A⁷

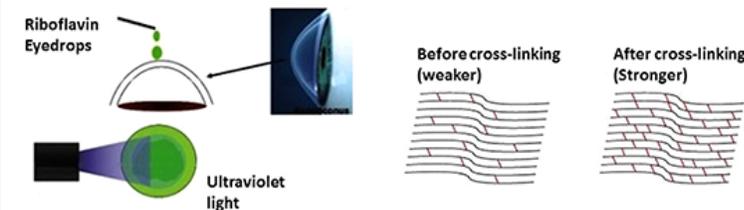


Image 4: LASEK procedure involving alcohol assisted epithelial separation and topography guided excimer laser⁸



Results

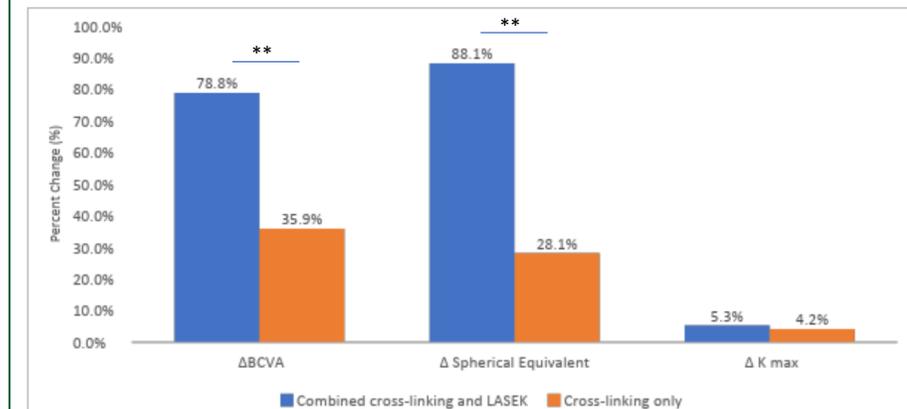
Vision and Refraction

- Preoperatively, there were no significant differences in spherical equivalent (SE) or BCVA between groups
- Compared to the CXL-only group, the combined CXL-LASEK group showed marked improvement in postoperative BCVA ($p < 0.02$) and SE ($p < 0.01$) at 12 months

Corneal Stability

- There was clinically significant improvement in topographic keratometry among both groups at 12 months
- There were no significant differences in postoperative keratometry between groups

Figure 1: Percent change in preoperative and 12-month postoperative BCVA, spherical equivalent, and K max between groups



Conclusion

Combining photochemical corneal CXL with LASEK may be a safe and effective treatment for halting the progression of KC while providing marked improvement in functional vision. Further research is needed to assess the long-term effects of this procedure and whether it may prevent the need for corneal transplantation among keratoconic eyes.