Photochemical Corneal Collagen Cross-Linking Combined with Refractive Surgery to Treat Keratoconus

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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 improvement. 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 thinning.
- As KC progresses, refractive lenses often fail to provide useful vision and is one of the most common indications for corneal transplantation.
- In 2016, the FDA approved corneal CXL induced by UV-A irradiation and photosensitizer riboflavin which has been shown to halt the progression of KC.
- This study evaluated the safety and efficacy of combining corneal CXL with refractive surgery in keratoconic eyes.

Methods

Patient population
- We conducted a single-site retrospective study of 41 keratic 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 LASERK (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).

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.

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.

Image 1: A normal cornea (left) compared to one with KC (right).
Image 2: Abnormal Topography of eye with KC.
Image 3: Photochemical corneal CXL with photosensitizer riboflavin and UV-A.
Image 4: LASEK procedure involving alcohol assisted epithelial separation and topography guided excimer laser.

*Superscripted references available upon request.