Case Report

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Combined photorefractive keratectomy and cross-linking. Pushing the limits

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Abstract:

Correction of refractive error through laser-assisted means has soared in popularity in recent years, allowing it to become an increasingly routine surgical procedure. Technique refinement and adjustments resulted in laser-assisted refractive surgery to be combined with treatments such as collagen cross linking (CXL). This has broadened safety parameters and widened the treatment boundaries. Laser correction combined with CXL has been advocated in the treatment of high refractive errors as a safe option for full refractive correction while increasing corneal biomechanical stability. We present a complicated case where a young female patient with a preoperative best-corrected visual acuity (BCVA) of 20/20 in each eye was fully corrected by excimer laser followed by CXL. Factors potentially leading to inflammation, such as ocular surface disease, in addition to laser treatment and CXL, resulted in persistent epithelial defect followed by corneal melt and subsequent thinning. After the treatment, the patient relies on rigid gas-permeable contact lenses, achieving a BCVA of 20/25 and 20/23 in the right eye and left eye, respectively.

Keywords:

Atopy, collagen cross-linking, melt, photorefractive keratectomy

Introduction

Correction of refractive error through laser-assisted means has become an increasingly routine surgical procedure over the years. Combination therapy in which refractive laser is combined with corneal collagen cross-linking (CXL) has broadened safety parameters as it is thought to increase corneal biomechanical stability.[1] Prophylactic CXL concurrently with high myopic laser-assisted *in situ* keratomileusis appears to improve refractive and keratometric stability.[2]

Combination treatment can trigger a higher level of inflammation than laser-assisted *in situ* keratomileusis or photorefractive keratectomy (PRK) alone. Moderate-to-severe atopy can coincide with blepharitis, and they often go undetected or undertreated. This condition can lead to compromised surgical outcomes and complications such as diffuse lamellar keratitis postlaser-assisted *in situ* keratomileusis, nonhealing corneal epithelial defect, and, in severe cases, stromal inflammation and melt.[3]

Case Report

We present a case of a 29-year-old woman with a history of increasing discomfort, reduced vision, and photophobia in both eyes. Two months earlier, she underwent combined PRK with mitomycin C (MMC) (0.02% 20 s) and accelerated CXL (18 mW/cm^2 5 min) in another service. Her refractive procedure was reported uneventful. Her preoperative refraction was $-7.75/-0.75 \times 10^{o}$ (right eye) and $-7.50/-1.00 \times 170^{o}$ (left eye). The patient had a best-corrected visual acuity (BCVA) of 20/20 in the right and left eyes, relying on soft contact lenses for a number of years. The preoperative central corneal thickness

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was 465 μm and 468 μm in the right eye and left eye, respectively. Corneal topography revealed no evidence of keratoconus [Figure 1]. No other information on the procedure was available to us. The patient had a past history of eczema, blepharitis, and atopy but no associated connective tissue disorder or other significant known past ocular history.

Following her refractive procedure, she had experienced good vision for approximately 1 week. At her 1-month postoperative follow-up (under her original surgeon), she was documented to have visual acuity of 20/40 in the right eye and 20/50 in the left eye. She was diagnosed with an epithelial defect bilaterally and was treated with a bandage contact lens, autologous serum, topical dexamethasone, topical ofloxacin, and oral doxycycline 100 mg. Due to continuing deterioration, she had amniotic membrane overlay bilaterally, held in place with a ring conformer. This remained in place for a period of only 2 weeks, as it leads to reduced vision despite improved comfort. The patient at that point sought second opinion in our service due to continuing deterioration. On examination, she was extremely photophobic and her vision was reduced to 20/100 in each eye. There was evidence of seborrhoeic blepharitis and meibomian gland dysfunction as well as the presence of only a few staphylococcal collarettes. Papillary reaction on the palpebral conjunctiva and corneal de-epithelialization with central corneal thinning were seen bilaterally. Diagnosis of bilateral corneal melt was made.

Corneal topography showed reduced central corneal thickness of 466 μm and 339 μm at the thinnest point in the right eye and left eye, respectively [Figure 2]. The patient's atopic conjunctivitis and ocular surface disease were managed with topical olopatadine twice daily (antihistamine mast-cell stabilizer combination),

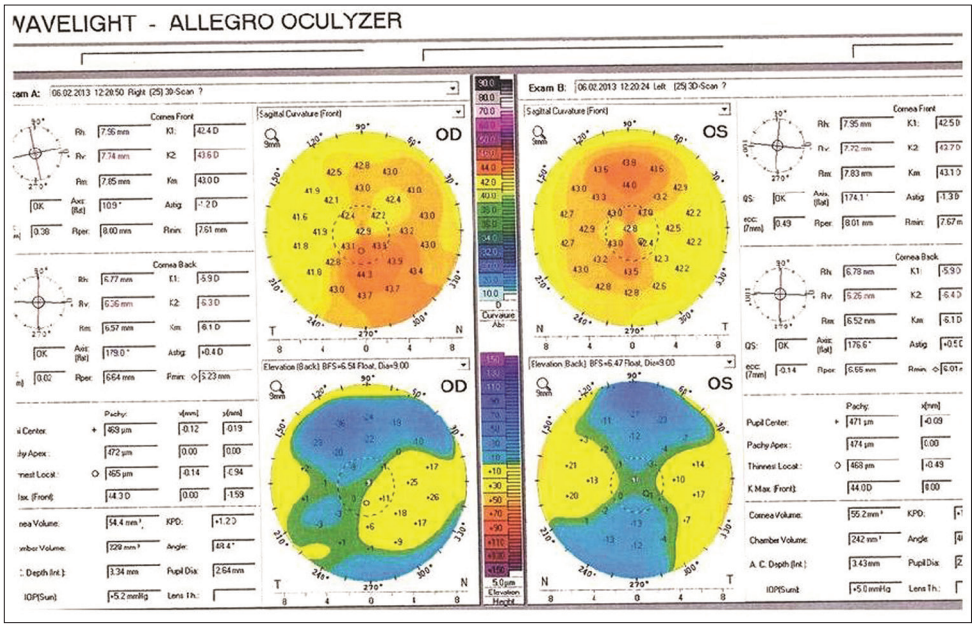

Figure 1: Preoperative corneal topography

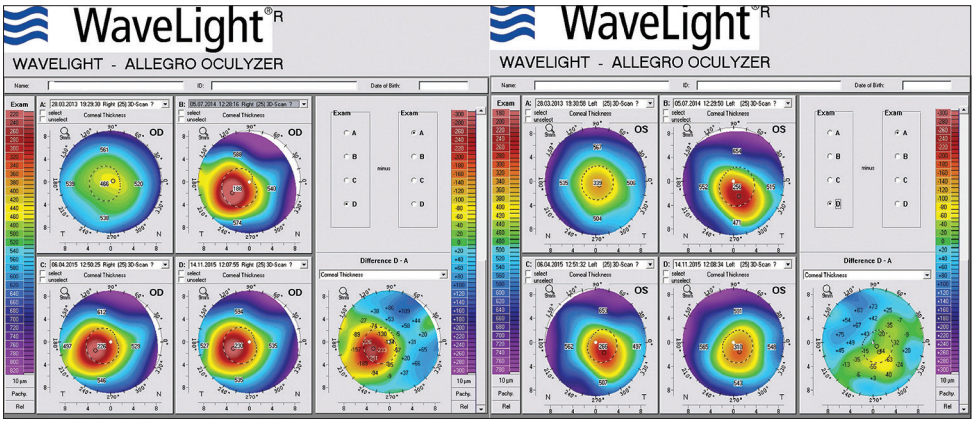

Figure 2: Pentacam image showing early and late post photorefractive keratectomy and collagen cross-linking corneal pachymetry

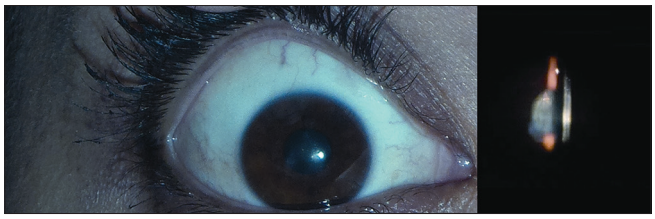

Figure 3: Corneal scarring 1-year postcombined photorefractive keratectomy with collagen cross-linking

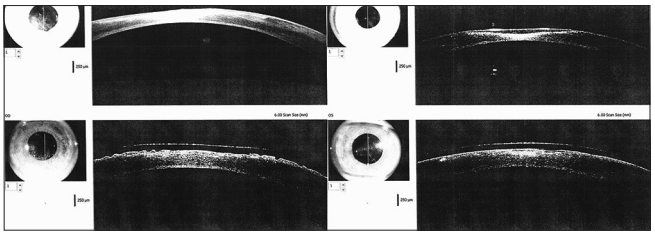

Figure 4: Optical coherence tomography of the cornea showing the presence of tissue loss and scarring

copious ocular lubricants hourly, and punctal plugs and mild topical steroid (prednisolone phosphate 0.5%) drops six times daily. Oral metalloproteinase inhibitor (tablets doxycycline 100 mg once twice daily) and lid hygiene with hot compresses twice daily were applied. The patient's epithelium healed after 5 weeks of treatment. Central corneal thickness was 188 μm in the right eye and 256 μm in the left eye at the thinnest point [Figure 2]. We suspect that at initial presentation to us, the corneal stroma was deceptively swollen due to the corneal epithelial defects and stromal inflammation. This led to substantial corneal edema, with falsely increased corneal thickness readings. At the last follow-up, her corneal thickness was 230 μm and 310 μm [Figure 2], and her visual acuity was 20/25 and 20/23 with rigid contact lenses in the right eye and left eye, respectively. The eyes were quiet, and lid disease was well controlled, but there was evidence of multiple stromal corneal opacities [Figure 3]. Optical coherence tomography of the cornea highlighted the presence and progress of tissue loss and the healing process [Figure 4].

Discussion

PRK is generally considered, nowadays, as a treatment option for low myopia or in specific groups of patients such as patients with thin corneas.[4] Although no clinical trials have been published on the prevention of post-PRK ectasia with PRK and CXL, there is some evidence regarding its use.[5] CXL can lead in the first postoperative months to a reduction of stromal keratocytes and corneal scarring.[6] We believe that, it was this actual reduction in keratocytes combined with postoperative inflammation, ocular surface disease, atopy and the use of MMC that instigated the persistent epithelial defect, corneal melt, and the subsequent thinning. Combined PRK and CXL has shown promising results in the treatment of keratoconus and postlaser-assisted *in situ* keratomileusis ectasia, where only partial surface ablation is performed.[6,7] In this case, PRK ablation was performed for the whole refractive correction of −7.75/−0.75 × 10 (right eye) and −7.50/−1.00 × 170 (left eye). The addition of CXL in the presence of ocular surface disease may have been a contributing factor to the complicated outcome. However, we cannot definitely exclude a potential damaging effect of CXL on the corneal endothelium, especially in view of the relatively low preoperative central corneal thickness. This endothelial damage may have aggravated the corneal edema and ensuing inflammation.

Although this patient is now comfortable, she relies on rigid gas-permeable contact lenses to achieve optimal albeit reduced visual acuity of 20/25 in the right eye and 20/23 in the left eye. Currently, the patient is satisfied with her BCVA with the contact lenses. Due to the severity of the corneal thinning and previous history of CXL, a deep anterior lamellar keratoplasty may prove impossible and penetrating keratoplasty may be the only viable alternative option.

It is imperative that ocular surface disease, blepharitis, and atopic keratoconjunctivitis are well controlled preoperatively in patients seeking refractive correction. These patients should be chosen with a lot of caution.

Conclusions

When considering combined procedures for the full correction of medium-to-high myopia in borderline thin corneal thickness cases, the application of MMC, CXL, and the underlying ocular surface diseases are all possible contributing factors for post-PRK corneal melting.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given her consent for her images and other clinical information to be reported in the journal. The patient understands that her name and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

The authors declare that there are no conflicts of interests of this paper.

References

1. Kanellopoulos AJ, Asimellis G, Salvador-Culla B, Chodosh J, Ciolino JB. High-irradiance CXL combined with myopic LASIK: Flap and residual stroma biomechanical properties studied *ex-vivo*. Br J Ophthalmol 2015;99:870-4.
2. Kanellopoulos AJ, Asimellis G. Combined laser *in situ* keratomileusis and prophylactic high-fluence corneal collagen crosslinking for high myopia: Two-year safety and efficacy. J Cataract Refract Surg 2015;41:1426-33.
3. Bielory BP, O'Brien TP. Allergic complications with laser-assisted *in situ* keratomileusis. Curr Opin Allergy Clin Immunol 2011;11:483-91.
4. Vestergaard AH. Past and present of corneal refractive surgery: A retrospective study of long-term results after photorefractive keratectomy and a prospective study of refractive lenticule extraction. Acta Ophthalmol 2014;92 Thesis 2:1-21.
5. Kanellopoulos AJ. Preventing ectasia with cross-linking after PRK or LASIK. Cataract Refract Surg Today 2012;50-4.
6. Kanellopoulos AJ, Binder PS. Management of corneal ectasia after LASIK with combined, same-day, topography-guided partial transepithelial PRK and collagen cross-linking: The Athens protocol. J Refract Surg 2011;27:323-31.
7. Tsatsos M, MacGregor C, Kopsachilis N, Anderson D. Is accelerated corneal collagen cross-linking for keratoconus the way forward? Yes. Eye (Lond) 2014;28:784-5.