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CASE REPORT

# Collagen Corneal Cross-Linking followed by Intac Implantation in a Case of Post-PRK Ectasia

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## ABSTRACT

Collagen corneal cross-linking (CXL) has proved to be effective in halting the progression of keratoconus and post-LASIK ectasia.

Post-photorefractive keratectomy (PRK) ectasia, a rare PRK complication, has been reported in only a few cases, although PRK is the oldest form of laser refractive surgery. CXL for post-PRK ectasia has not been reported yet.

Here is a case of a 22-year-old male who developed post-PRK ectasia more than 1 year after the procedure and was treated using CXL. A few months after CXL, an Intac (Addition Technology) was implanted due to contact lens intolerance.

**Keywords:** PRK, Ectasia, Collagen corneal cross-linking (CXL), Keratoconus, Intac, Intacs, Intrastromal corneal rings.

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## INTRODUCTION

Collagen corneal cross-linking (CXL) has proved to be effective in halting the progression of keratoconus.[1,2] The technique is under evaluation by the FDA. Preliminary results, which were presented at the 10th Agean cornea meeting, held in Crete in July of 2010,[a] confirm the previously reported benefits of the technique, i.e. halting the progression of keratoconus, improving the uncorrected visual acuity (UCVA) and best spectacle corrected visual acuity (BSCVA). Similar results were attained in cases of CXL treatment for post-LASIK ectasia.[3,4]

Post-photorefractive keratectomy (PRK) ectasia, a rare PRK complication, has been reported in only a few cases,[5-8] despite the fact that PRK is the oldest form of laser refractive surgery.

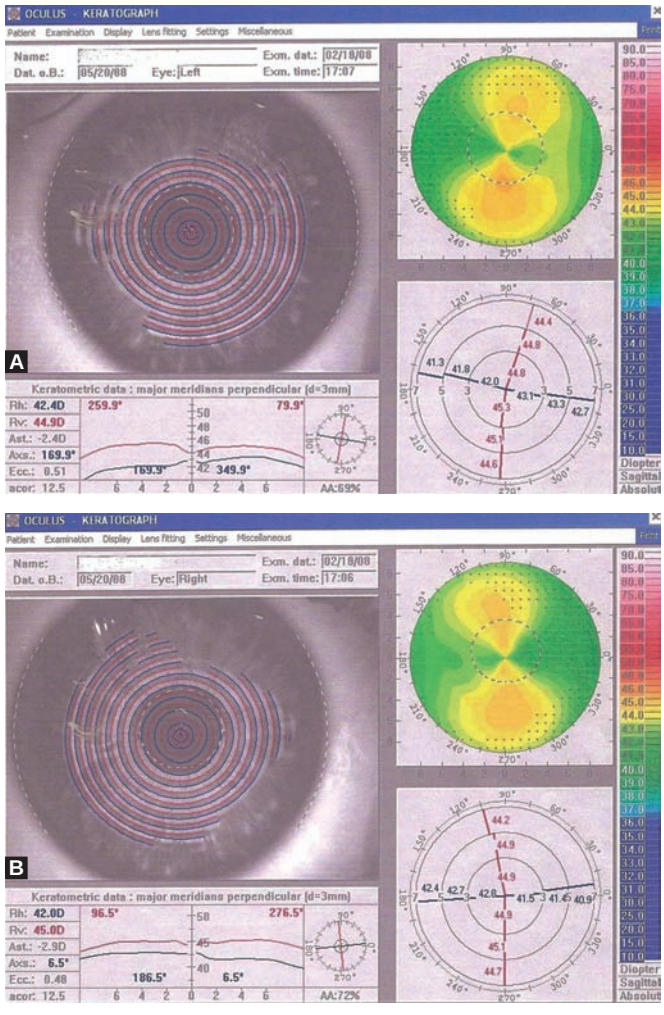
CXL for post-PRK ectasia has not been reported yet.

## CASE REPORT

A 22-year-old male was referred to our medical center for CXL, to treat post-PRK corneal ectasia.

He had undergone PRK in both eyes on March 2, 2008, in a private medical center. His preoperative refraction was –8 DS to –2.5 DC × 10° in his right eye (RE), –7 DS to –2.5 DC × 165° in his left eye (LE). His BSCVA was 20/30 in both eyes; the central corneal thickness (CCT) as measured by ultrasound pachymetry was 509 µm in the RE and 508 µm in the LE (Figs 1A and B). No other corneal imaging was performed. Total depth of ablation was 125 µm in the RE and 114 µm in the LE.

Fourteen months after PRK, he presented to his surgeon complaining of deteriorating visual acuity (VA) in his LE: UCVA was finger counting at 2 meters; refraction was –1.25 DC to –1.5 DS × 150° with BSCVA of 20/40 partial. Post-PRK ectasia was diagnosed and he was referred to our medical center for CXL.




**Figs 1A and B:** Pre-PRK topography in left and right eye

[a]The 10th Agean Cornea meeting, held in Crete, July 2010

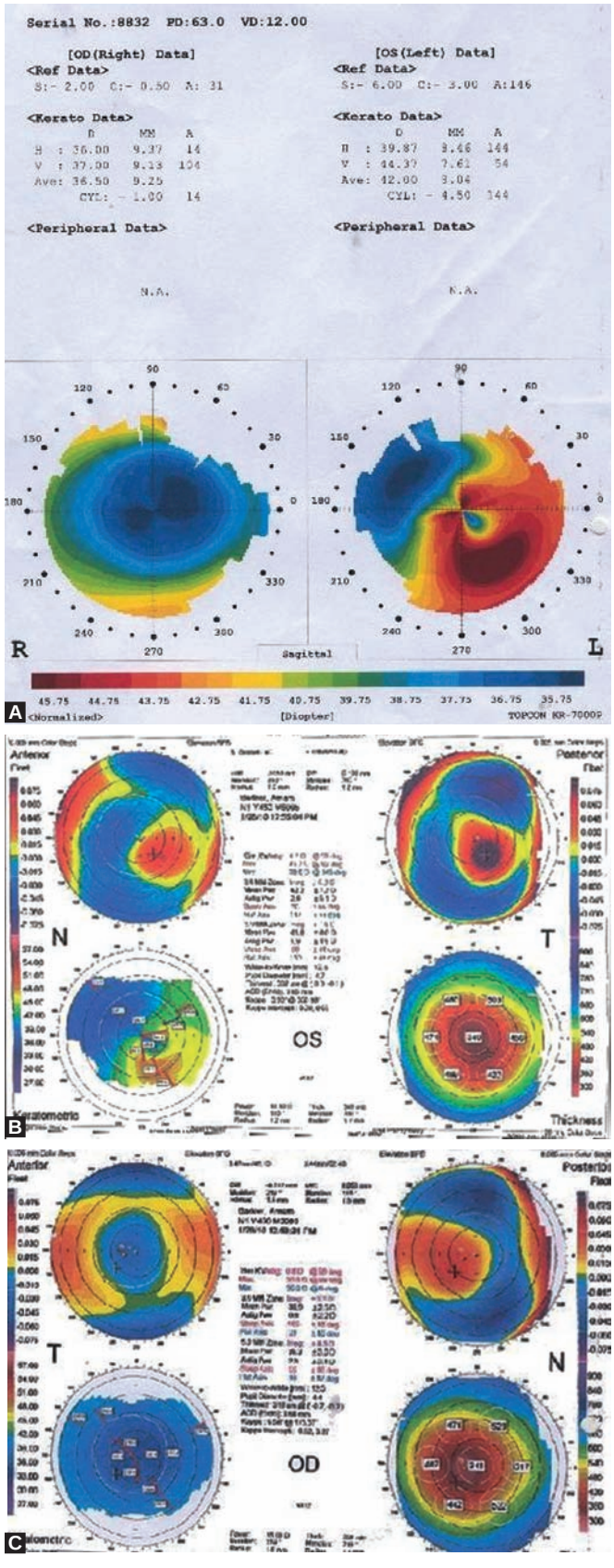
The preoperative UCVA in the LE was 20/400; refraction: Plano –7.0 DC × 130°, BSCVA 20/33 partial; keratometry (K) 39.87D to 44.37D, average K 42.0D (see topography and Orbscan II scan, Figs 2A to C). In the RE, UCVA was 20/33 partial, the refraction –0.5 DS to 0.5 DC × 30°, BSCVA 20/25 partial, the K readings 36D, 37D and K average was 36.5D. The patient's endothelial cell count (ECC) as measured by Konan Specular Microscope X Model: NSP-7700, was 2809 in the LE and 3049 in the RE; LE CCT was 334 µm, RE CCT was 356 µm. Except for mild corneal haze in both eyes, no abnormalities were detected on slit lamp examination. The fundus examination after mydriasis was unremarkable. We performed CXL in the LE.

## Surgical Procedures and Follow-up

CXL was performed according to the Dresden protocol; the epithelium was removed from the central 8 mm of the cornea, with the assistance of alcohol use, as in the laser-assisted epithelial keratomilleusis (LASEK). Riboflavin 0.1% without dextran, i.e. hypotonic riboflavin (Peschke Meditrade, Ltd.) was instilled every 5 minutes, until the appearance of a strong yellow flare in the anterior chamber (after almost half an hour) and until the thinnest corneal point as measured intraoperatively by ultrasound was >373 µm. A speculum was inserted and the eye was irradiated for a duration of 30 minutes by ultraviolet-A (UVA) at 365 to 370 nanometers, using the UVX device (Peschke Meditrade, Ltd. Germany). The light intensity was 3mWcm$^2$; the light source was 5 cm from the eye. During treatment, hypotonic riboflavin was instilled every 5 minutes and physiological saline every 3 minutes. A therapeutic contact lens was applied to the eye posttreatment and ofloxacin 0.3% (Allergan) was prescribed four times a day, until full epithelization, which occurred on day 3 postoperatively. Then fluorometholone 0.1% (FML, Allergan) was prescribed for 1 month, and then tapered gradually for another month.

No postoperative complications occurred and the preoperative mild haze did not increase. At 8 months post-surgery, the patient's UCVA was 20/400, the refraction: Plano –6 DC × 135°; K 39.62D × 43.12D, K average 41.25D, BSCVA 20/33 partial. These results indicated a 0.75D reduction in K average and 1D reduction in astigmatism (Fig. 3).

The patient tried to be fitted with soft keratoconus contact lens (CL) and rigid gas permeable CL but could not tolerate them, hence 8 months following CXL, an Intac (Addition Technology, USA) of 400 µm thickness was inserted in the cornea (inferiorly). The incision was done




**Figs 2A to C:** (A) Post-PRK topography, (B) post-PRK Orbscan II left eye, (C) post-PRK Orbscan II right eye

along the steepest axis. The choice of one Intac *vs* two Intacs was based on the refraction and the corneal topography. The manual technique was used; after topical anesthesia

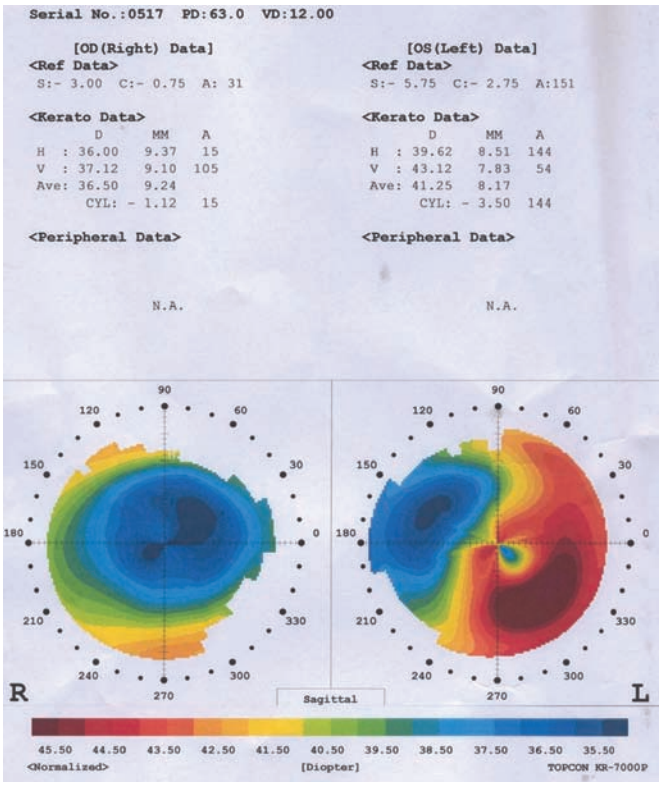



**Fig. 3:** Post-CXL topography

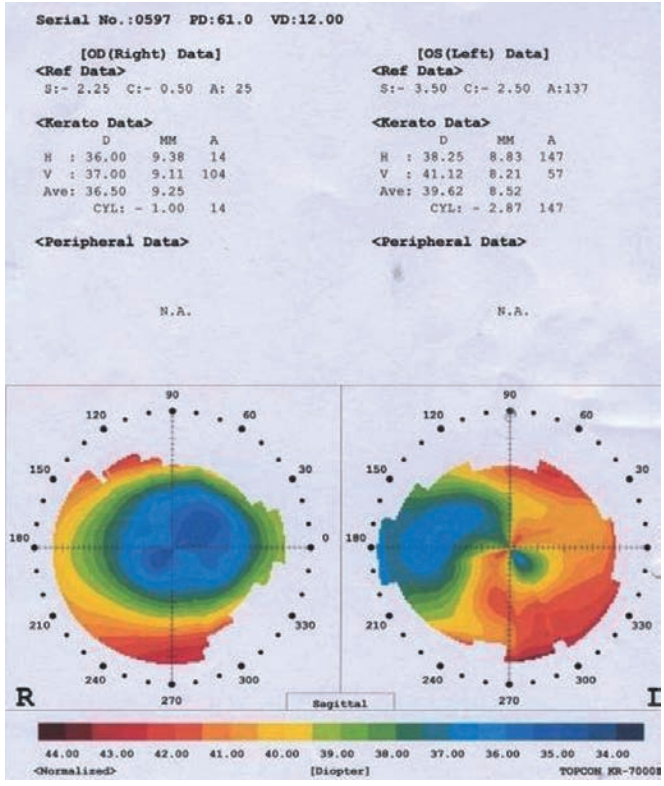



**Fig. 4:** Post-Intac topography

using benoxinate 0.1% and installation of sterile povidone solution of 4%, a speculum was inserted, a special Intacs marker was used to mark the incision site and the tunnels' position. Ultrasound pachymetry was performed to measure the corneal thickness at the incision site and at the inferior tunnel site. The diamond knife was set to a 75% depth of the corneal thickness at the incision site and pocketing was performed. Following the insertion of a suction ring and the application of level 1 suctioning, the clockwise dissector was inserted and rotated. No suture was used and no contact lens was applied. Moxifloxacin 0.3% (Vigamox, Alcon) was prescribed six times daily for 1 week and then four times daily for two additional weeks. No postoperative complications were noted.

At the last follow-up, 4 months post-Intac implantation and 1 year post-CXL, the patient's UCVA was 20/80, the refraction: Plano –3 DC × 110°, BSCVA 20/30 partial. K readings were 37.75D to 40.25D, K average was 39.0D (Fig. 4). The Intac was in place, in the inferior part of the cornea. The ECC was 2888 RE and 2859 LE, with normal morphology. ECC was performed using Konan-Noncon Robo SP 6000 (Noncon Robo) specular microscope (Konan Inc, Japan), a different device than that used during the preoperative examination, because the former was out of order. The patient was satisfied with the outcome. The RE refraction did not change.

## DISCUSSION

Post-LASIK ectasia is a well-known postoperative complication. Although generally underreported, there have been several reports published in the literature since the issue was first addressed by Theo Seiler et al.[9-18] Only few reports exist on post-PRK ectasia. Most are related to a forme fruste keratoconus or very deep ablations performed during PRK.

No report exists on CXL after PRK ectasia. CXL is indicated for halting the progression of keratoconus[1,2] and post-LASIK ectasia.[3] In this case we were reluctant to perform CXL in a cornea from which more than 110 µm were removed and expose it to UV light which may cause additional haze.[19] This issue was addressed in the informed consent document.

In the current case, CXL arrested the progression and reduced the astigmatism by one diopter and slightly reduced the keratometry readings and did not induce further haze.

Intacs are indicated for the treatment of keratoconus with satisfactory short- and long-term results[20-27] and in post-LASIK ectasia even in severe cases.[28-35] When the BSCVA is unsatisfactory and contact lenses are not tolerated, the Intacs improve UCVA and BSCVA, reduce astigmatism and K readings. In our case, the single implanted Intac realized all of these goals. The combination of CXL and Intacs has been reported to have an additive effect beyond that of either of the two techniques.[36-40]

Typically, the order of the treatment is first to insert Intacs and later perform CXL. This order was supported by a prospective study that compared the different possible sequences: CXL followed by Intacs implantation and Intacs implantation followed by CXL. As reported,[39] the latter proved to yield better results. However, in our case, we had to first perform CXL because the patient's vision was deteriorating and the patient preferred to halt the progression of the ectasia and then try to use contact lenses.

The ECC, although measured by different devices, was the same in both the cross-linked and the noncross-linked eyes; the morphology of the cells in both eyes was normal.

## CONCLUSION

In our case report, CXL was found to be a safe treatment for post-PRK ectasia; no additional haze developed, the astigmatism and the K readings were reduced, there was no loss in ECC. The insertion of the Intac segment improved UCVA, BSCVA and further reduced astigmatism and K readings.

Additional studies are needed to confirm these positive results of combined CXL and Intacs for the treatment of post-PRK ectasia.

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