# The management of corneal blindness from severe cornea scarring, with the Athens Protocol (transepithelial topography-guided PRK therapeutic remodeling, combined with same-day collagen cross-linking)

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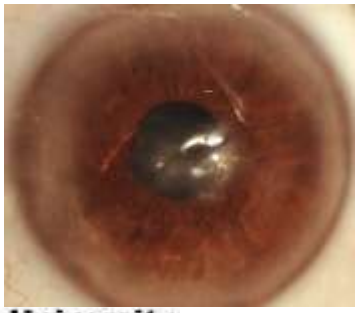
*Financial Interest: Alcon/Wavelight*

INTRO: To evaluate the safety and efficacy of this alternate approach to severe corneal blindness due to scarring.

A bilaterally blind patient from fireworks explosion of over 35 years was treated with the Athens Protocol, employing the Wavelight topography-guided platform and CXL with 10mW/cm² for 10 minutes.

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# The Athens Protocol 4 steps:

same day PTK > topoPRK > MMC > CXL (10mW/cm2 x 10 min)

1st PTK

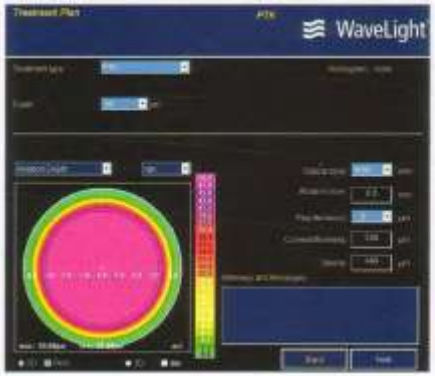


Figure 4.1: Epithelium removed with 50 micron PTK

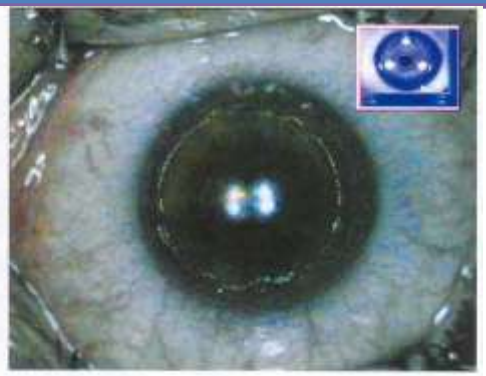

Figure 4.3: Topography-guided PRK to correct part of the refractive error (TCAT treatment plan) maximal thickness removal 50 microns

4th: CXL

2nd: topo -guided PRK

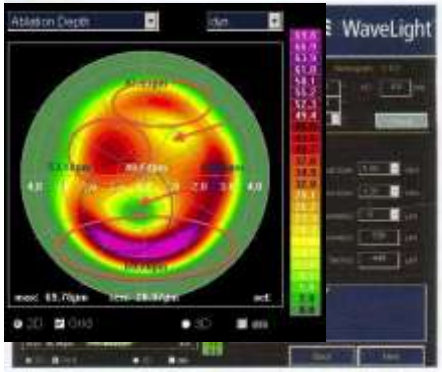


Figure 4.2: TC at treatment plan

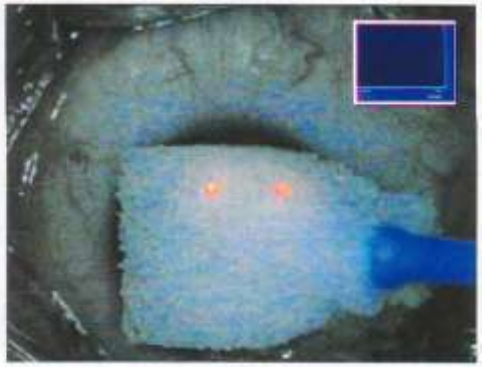

Figure 4.4: MMC solution 0.02% for 20 seconds

3rd: 30" MMC

Please note that in proprietary topo-guided software of the Alcon/Wavelight platform The flat areas are steepened by adjacent hyperopic-like ablations-red ovals seen above, and the steep areas are treated minimally-red arrows. This software offers the unique ability to approach the best-fit sphere model even in highly irregular corneas, with the advantage of minimal tissue removal, when compared to wavefront-guided alternative options

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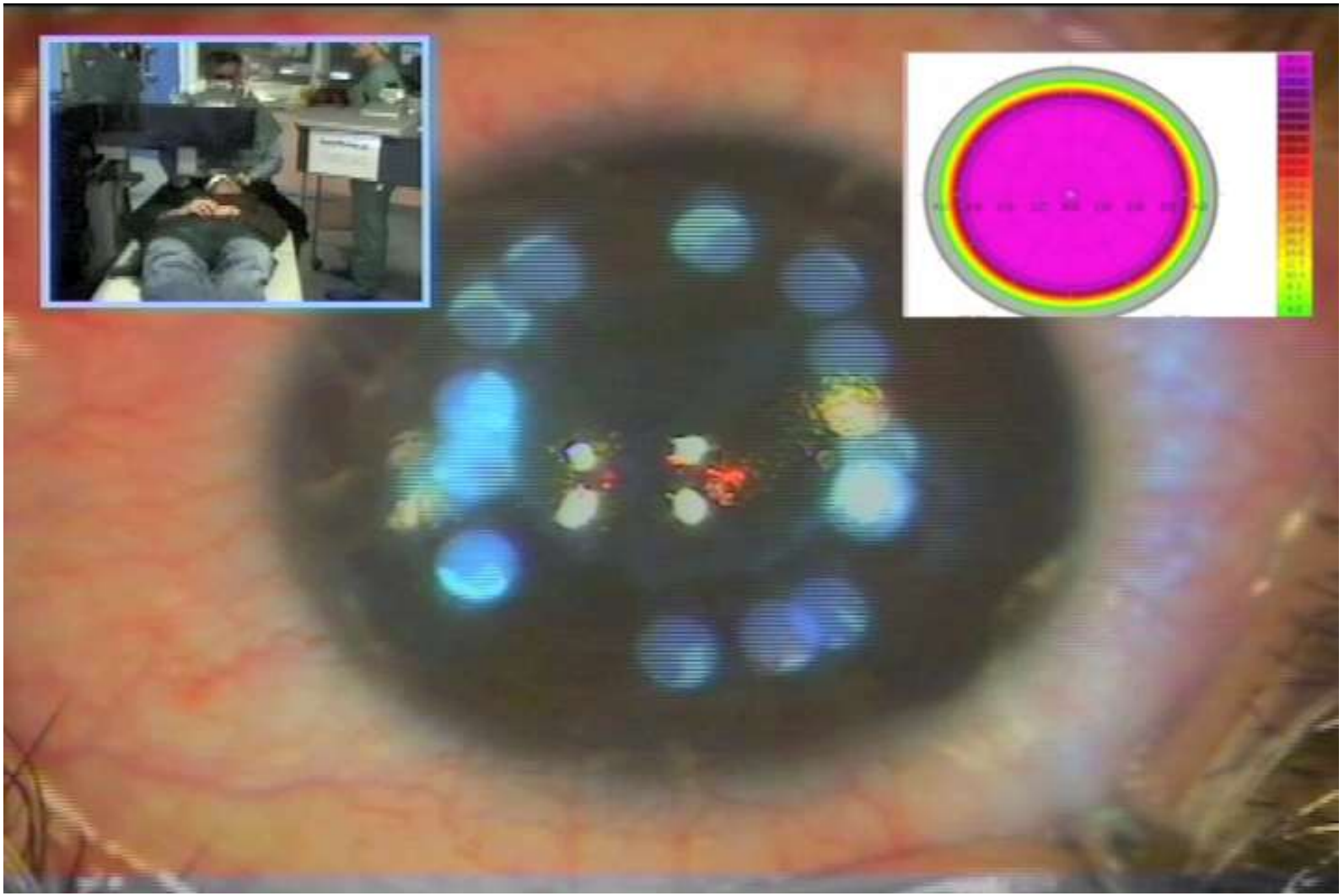
# The Athens Protocol, in short video:



Visual acuity improved from UCDA 20/200 in the OD ad 20/100 in the OS to 20/50 and 20/30 reprectively. The CDVA improved from 20/100 and 20/80 to 20/40 and 20/30 respectively. Cornea Topography, tomography endothelial cell counts and OCT were employed to document efficacy and safety.

Image A: Slit lamp of the OD at presentation, showing the significant horizontal cornea scar.

Image B: Slit lamp picture of the OS .The cornea scar similar to the OS.

Image C: The treatment plan on the Alcon/Wavelight excimer platform for topography-guided partial PRK employed for the OD treatment. The treatment plan-pivotal to the application of the Athens Protocol-combines a myopic ablation over the elevated cornea and a partial hyperopic application peripheral to the flattened by scarring inferior cornea. This combination treatment enhances the normalization of the severe irregularity with small ablation (35um) over the thinnest conrea.

Image D: Tomography maps (Oculyzer, Wavelight, Erlagen, Germany) of the OD and OS pre-operative to the Athens Protocol.

Image E:: Tomography maps of the OD and OS post-operative to the Athens Protocol. 15 months following the OD and 8 months following the OS

Image F: Slit lamp Picture of the OD, 15 months following treatment, cornea regularity and improvement in translucency is evident (when compared to Image A).

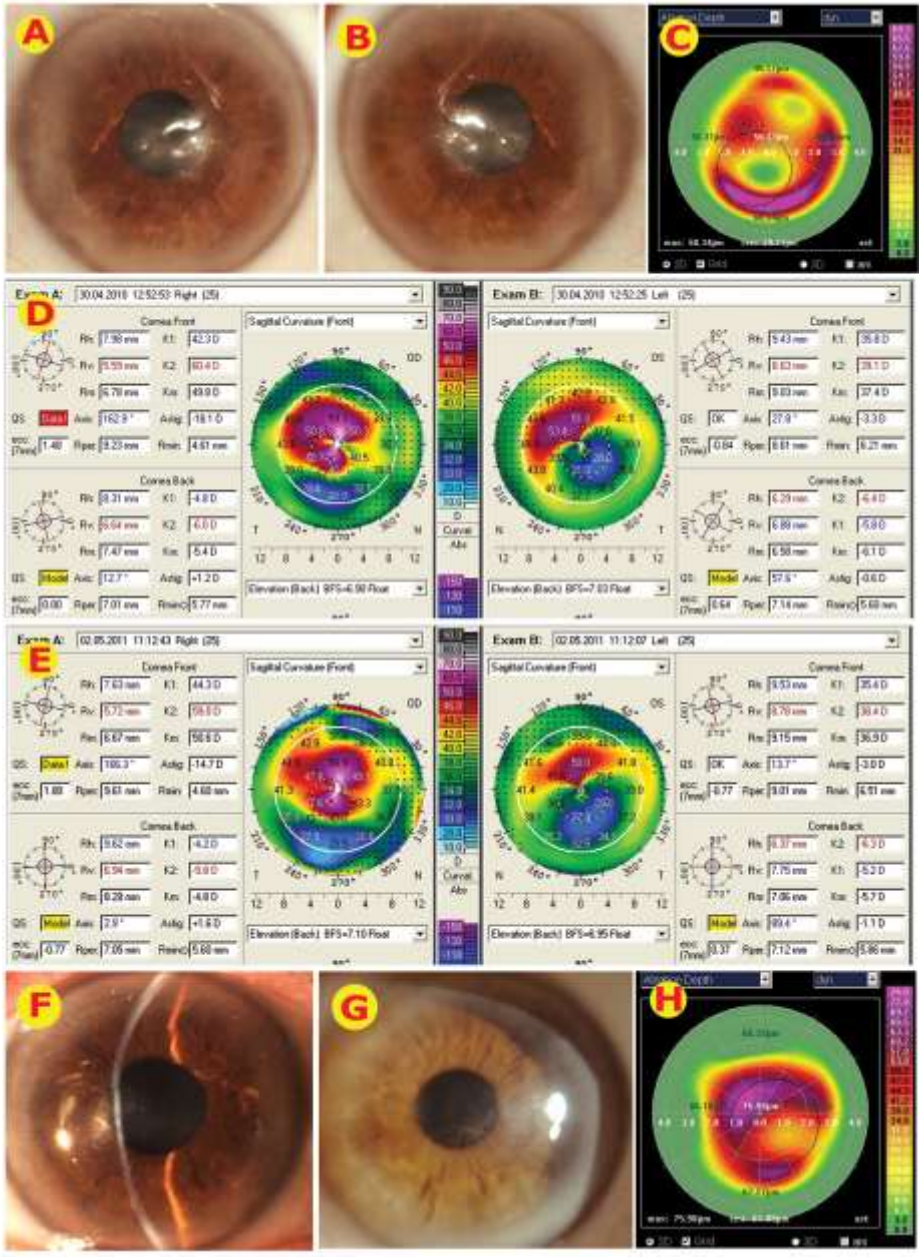
Image G: Slit lamp Picture of the OS, 8 months following treatment, cornea regularity and improvement in translucency is evident (when compared to Image B).

Image H: The treatment plan on the Wavelight excimer platform employed for topography-guided partial PRK of the OS.

Figure 2: preoperative cornea OCT showing the dense, deep stromal scarring )hyper-reflective spots) along with the very irregular stromal surface, partly masked by epithelium thinning over the peaks and thickening over the deep valleys.

Figure 3`: shows the same portion of cornea of figure 2, in a cornea OCT 12 months following the treatment.

The scar has been significantly reduced, the stromal surface smoothed, the epithelium has become more uniform in thickness and the overall cornea thickness has been reduced.



# Conclusions

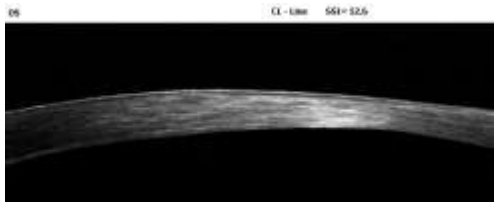
In this particular patient, the therapeutic aim of the topography-guided therapeutic PRK was to attempt to normalize the highly irregular corneal surface, and the employment of the collagen-cross linking had a twofold objective: to reduce corneal scarring by eliminating keratocytes, and to stabilize the thinner cornea produced by the removal of corneal tissue with the therapeutic topography-guided ablation.

The “smoothing’ of the steep stromal edges achieved with the topography-guided normalization, seen clearly in the OCT images to the right, may have also contributed to the reduction of stromal haze

We feel that the introduction of in this case successful management of severe cornea abnormalities and scarring with the Athens Protocol, may provide an effective alternative to other surgical options such as lamellar or penetrating keratoplasty. Further studies in a large cohort of patients with a longer follow up is needed to further establish the effectiveness and safety of this technique.

OCT before

OCT after



Treatment plan