

FP 2878



Introduction of quantitative and qualitative Optical Coherence Tomography findings, induced by collagen cross-linking for keratoconus.

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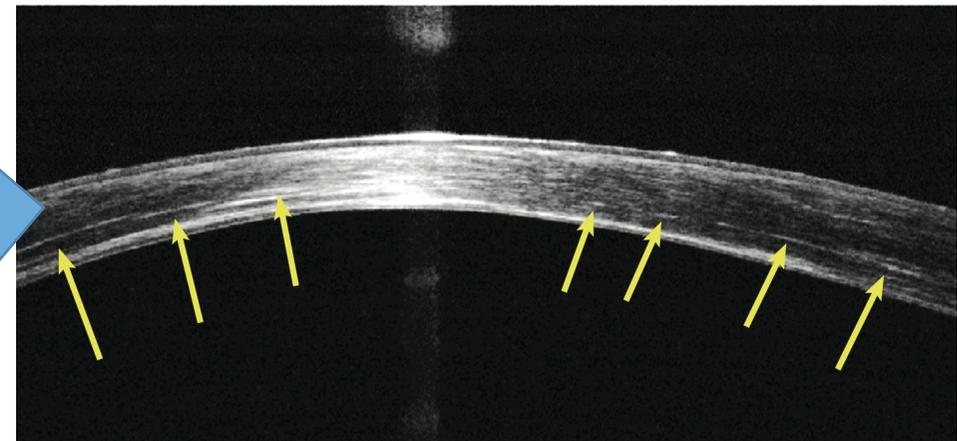
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Purpose

- To introduce a novel, non-invasive technique to determine the
- depth and extent of anterior corneal stroma changes induced by collagen cross-linking (CXL) using
- quantitative analysis on high resolution anterior-segment optical coherence tomography (OCT) post-operative images.



A cornea OCT demonstrating hyper-reflective intra-corneal stromal “lines” at 2/3 depth (yellow arrows) corresponding with the clinical presence of CXL demarcation line in a patient, 3 years following the combined Topography guided-PRK/ and CXL procedure.

Methods

- Two groups of corneal cross-sectional images obtained with the Optovue RTVue (Optovue Inc. Fremont, CA) anterior-segment Optical Coherence Tomography (OCT) system were studied:
- The first (control) group consisted of corneas unoperated, otherwise healthy, save for possible refractive error. All images were recorded during scheduled exam visits.
- The second group consisted of keratoconic (KCN) corneas previously operated with collagen cross-linking (CXL). All images were recorded during scheduled post-operative procedure visits.
- The two groups of images were investigated for possible quantitative evidence of changes induced due to cross-linking. Such evidence was considered intrastromal hyper-reflective areas (defined as the area consisting of pixels with luminosity greater than the mean $\pm 2 \times$ standard deviation of the entire stromal cross section) within the corneal stroma, and correlation between the extent and depth of the hyper-reflected area was assessed.

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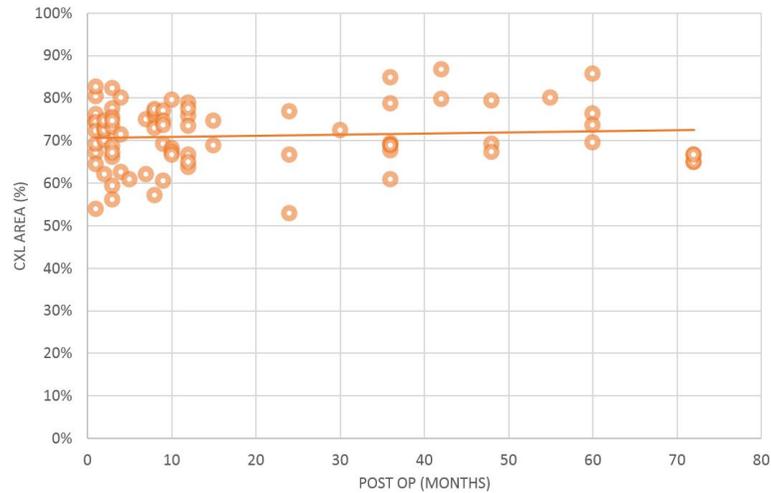
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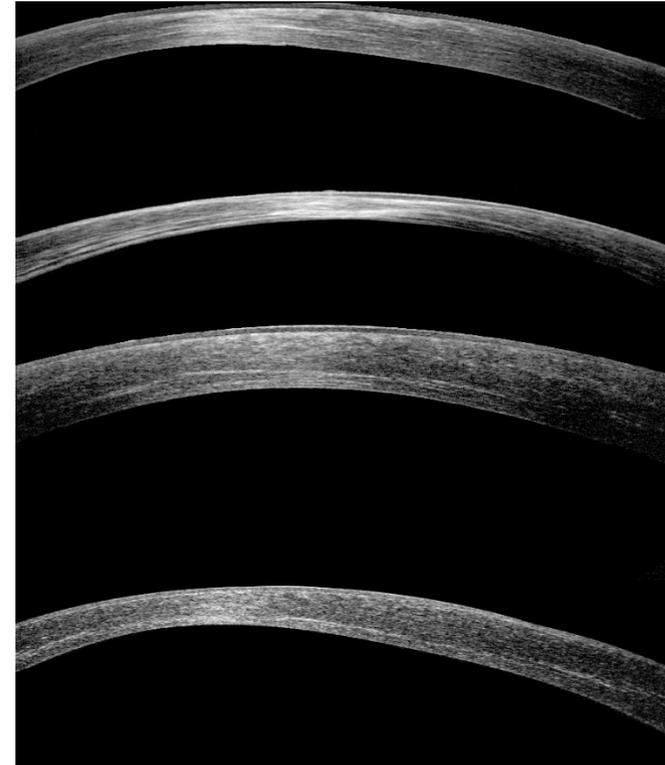
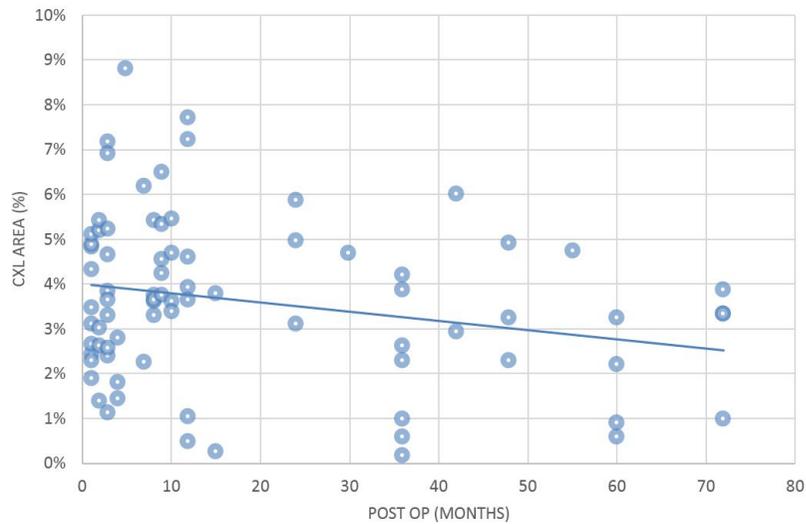


Results

Area Stability
5 years



Depth Stability
5 years



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Results

- In the second group (KCN patients treated with CXL), in all images there was evidence of intrastromal hyper-reflective area. Its areal extent ranged from 0.2 to 8.8% of the cross-sectional area (mean \pm standard deviation $3.46 \pm 1.92\%$).
- The hyper-reflective area horizontal extent ranged from 4.42 to 99.2 % ($56.2 \pm 23.35\%$) of the imaged corneal range, while the axial extent (vertical in the image) ranged from 40.00 to 86.67% ($70.98 \pm 7.85\%$).
- There was significant statistical difference ($P < 0.02$) when compared to the control group, in which, by application of the same criteria the same hyper-reflective area ranged from 0.00% to 2.51% ($0.74 \pm 0.63\%$).

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Conclusions

- ✓ AS-OCT appears to demonstrate reproducible early and long-term CXL cornea findings.
- ✓ The hyper-reflective 'lines' may represent induced cornea density or subtle intrastromal cornea scarring.
- ✓ This may constitute a possible novel non-invasive measurement, to evaluate and titrate the amount, extent and depth of intra-stromal effects of the CXL treatment in keratoconic and possibly ectasia eyes.

