Add or Subtract, the Contact is Back

Contact lens fitting after intrastromal corneal ring segment removal and topography-guided partial photorefractive keratectomy with corneal collagen crosslinking for keratoconus

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BACKGROUND

Surgical options are frequently considered for keratoconus patients with contact lens intolerance in order to regain functional vision.[1] Normalization of corneal shape can be achieved with *additive* techniques such as intrastromal corneal ring segments (ICRS)[2] or *subtractive* techniques such as excimer laser ablation where tissue is removed.[1] The cornea is strengthened through corneal collagen crosslinking (CXL). Topography-guided partial photorefractive keratectomy (PRK) with CXL strives to simultaneously normalize and strengthen the cornea while improving long-term visual outcome.[1, 3]

Due to refractive fluctuations during the healing process after partial PRK with CXL, some surgeons advise against fitting contact lenses within the first year or until the cornea has completely stabilized. Despite improvements in vision after combined surgical techniques, some form of vision correction may still be required for activities of daily living. For these patients, soft contact lenses may serve a dual purpose in correcting some residual refractive error while supporting early corneal epithelial healing. Contact lenses serve a critical role in providing functional vision during the pre and post-operative periods.

CASE DESCRIPTION

A 51-year-old Caucasian male with history of progressive keratoconus and longstanding contact lens intolerance with gas permeable and scleral lenses presented seeking options for vision improvement. He had ICRS superior and inferior OS and was interested in other surgical options to aid acuity and slow progression. Although no signs were currently present, due to increased risk of corneal melt or ICRS erosion especially with additional surgical procedures, the patient elected to have ICRS OS removed. He planned to undergo topography-guided partial PRK combined with CXL OU in hopes of improved vision and less progression. While waiting for the cornea to moderately stabilize prior to surgery, the patient was fit in SpecialEyes toric contact lenses (see Table 1 below). After several trials, a good fit was achieved and the patient reported good comfort and vision.

Table 1: Pre-op SpecialEyes contact lens parameters.

Pre-Op CLRx	OD	OS
Base Curve	8.30mm	8.00mm
Diameter	14.9mm	14.7mm
Power	-1.25-5.75x085	-2.25-5.75x088
VA	$20/25^{-2}$	$20/20^{-2}$
Lens Design	54% Water Toric	54% Water Toric
Material	Hioxifilcon D	Hioxifilcon D

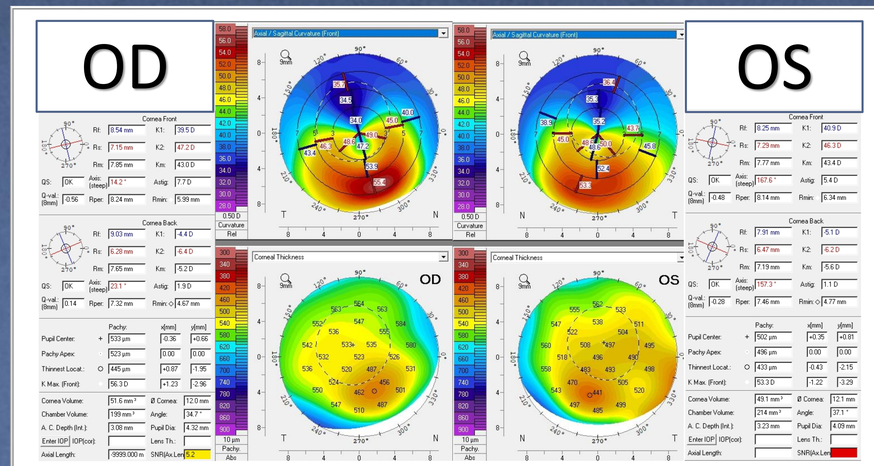

Figure 1: Pre-operative topography and pachymetry OD after ICRS removal OS.

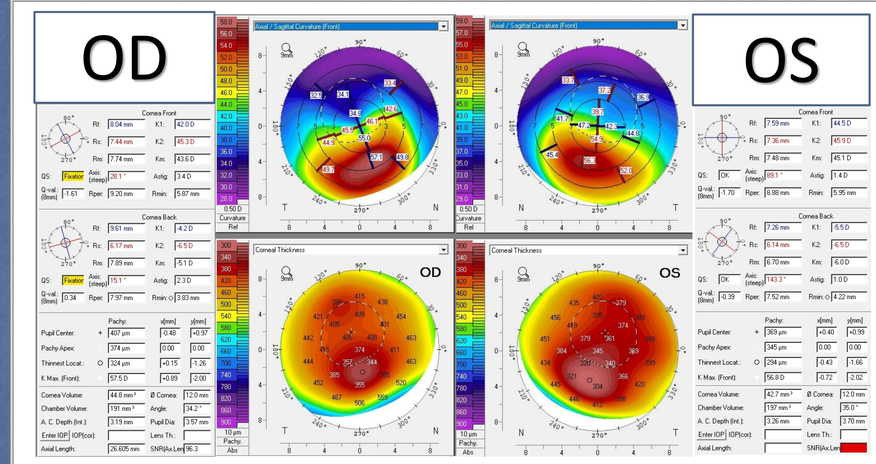

Figure 2: Topography and pachymetry 3 months post-op after topo-guided partial PRK and CXL OU. Note the reduction in corneal astigmatism OU.

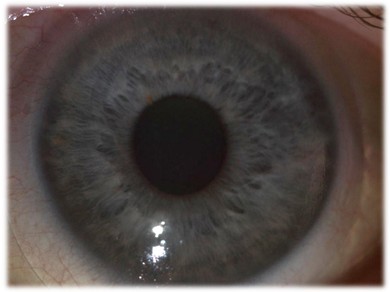

Figure 3: SpecialEyes contact lens OS showing 5° left stable rotation. Movement Movement was minimal, but no corneal staining was observed OU after removal.

RESULTS

Despite excellent visual acuity with soft contact lenses, the patient proceeded with the surgical plan due to continued signs of keratoconic progression. As a result of poor epithelial healing after three weeks, debridement was repeated and a bandage contact lens reapplied. Three weeks later, only a small epithelial defect remained, and SpecialEyes lenses were again selected to correct the residual refractive error. Trial lenses were empirically ordered for off-label surgical use in two diameters, 14.3mm and 14.7mm. The larger diameter proved to be more stable, more comfortable, and provided better visual correction which was further refined during the healing process (Figure 3). The epithelium was completely healed after two weeks of contact lens wear. By three months post-op, corneal astigmatism was reduced by 4.3DC OD and 4.0DC OS (Figure 1 and 2).

SRx	Pre-Op	Post-Op
OD	-3.00-4.75x100 20/40	-1.50-4.00x086 $20/30^{-2}$
OS	+0.50-8.00x091 $20/30^{-1}$	-0.75-4.50x090 $20/40^{-2}$

SRx continued to fluctuate with large variations in sphere and astigmatic correction during the first three months post-op. The values above reflect the best measures pre and post op for each eye.

Final CLRx	OD	OS
Base Curve	8.20mm	8.00mm
Diameter	14.7mm	14.7mm
Power	-3.50-3.50x090	-1.75-4.25x101
VA	$20/25^{+1}$	$20/30^{+2}$

CONCLUSIONS

CXL is considered the standard of care to halt progression of keratoconus, however, patients are extensively counseled that improvement in vision should not be expected. Simultaneous topography-guided partial PRK and CXL work in synergy to improve the biomechanical strength of the corneal stroma and reduce surface irregularities resulting in better visual outcomes, however, visual stability may require several months.[1,4] While the goal of this combined process is to normalize corneal asphericity,[5] the amount of refractive correction is often limited by the thinnest pachymetry measure.

Contact lenses play a critical role by providing functional vision following this combined process of corneal normalization and stabilization. Early rehabilitation can be achieved with contact lenses during the post-operative period to optimize vision and improve quality of life. The usual visual rehabilitation after PRK and CXL takes months. Patients are usually advised to wait on contact lens wear until their eyes are stabilized. Early rehabilitation can be achieved with contact lenses during the postoperative period to optimize vision and improve quality of life. This is especially important if the procedure is performed on both eyes on the same day.

REFERENCES

1. Kanellopoulos A. Ten-Year Outcomes of Progressive Keratoconus Management With the Athens Protocol (Topography-Guided Partial-Refraction PRK Combined With CXL). *J Refract Surg.* 2019; 35: 478-483.
2. Il Hwan Koh, Kyoung Yul Seo, Seong Bae Park, et al., "One-Year Efficacy and Safety of Combined Photorefractive Keratectomy and Accelerated Corneal Collagen Cross-Linking after Intacs SK Intracorneal Ring Segment Implantation in Moderate Keratoconus," BioMed Research International, vol. 2019, Article ID 7850216, 10 pages, 2019.
3. Mallias IA, Mylova P, Mouzaka A, et al. Partial transepithelial topography-guided PRK combined with corneal collagen crosslinking in patients with keratoconus. *Ophthalmol J.* 2016;1(4):133-136.
4. Sherif AM, Ammar MA, Mostafa YS, Gamal Eldin SA, Osman AA. One-Year Results of Simultaneous Topography-Guided Photorefractive Keratectomy and Corneal Collagen Cross-Linking in Keratoconus Utilizing a Modern Ablation Software. *J Ophthalmol.* 2015;2015:321953.
5. Pahuja NK, Shetty R, Sinha Roy A, et al. Laser Vision Correction with Q Factor Modification for Keratoconus Management. *Current Eye Research.* 2017;42(4):542-548.

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