The Post-RK Moving Target

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History of Radial Keratotomy (RK)[1]

1940s – Dr. Tsutomu Sato of Japan performs the first internal RK procedure on keratoconic patients. This internal technique damaged endothelial integrity and ultimately led to corneal decompensation and need for corneal transplants in these patients.

1970s – Dr. Svyatoslav Fyodorov of Russia performs the first documented external RK procedure after observing that a patient's myopic refractive error decreased following radial glass shard foreign bodies removed from their eyes.

1978 – RK begins in the United States and quickly gains popularity resulting in hundreds of thousands of myopic patients undergoing this procedure.

1994 – The Prospective Evaluation of Radial Keratotomy (PERK) Study is published demonstrating the likelihood of hyperopic shift 10 years after RK.

***1995** – photorefractive keratectomy (PRK) approved in the United States*

***1999** – laser assisted in situ keratomileusis (LASIK) approved in the United States*

RK Procedure

PROCEDURE
- Most commonly 4-16 radial incisions into the corneal stroma
  - *Greater number of incisions = greater effect on myopia reduction*
    - *Upper limit of this effect is ~16 incisions; anything more does not yield greater effect*
- Peripheral elevation/steepening of tissue results in central flattening

SIDE EFFECTS[1]
- Quality of vision issues such as glare, haloes, and diurnal fluctuations
- Reduction in biomechanical strength of corneal tissue at incision sites = increased vulnerability to traumatic lesions and/or globe rupture

UNPREDICTABILITY OF REFRACTIVE OUTCOMES[2]
- Biologic variability from one patient to another
- Variation in surgical technique among different surgeons
- Difficulty in making all incisions uniformly; difficult repeatability
- Inability to measure and control the biomechanical properties of the cornea

WOUND HEALING[3]
- Histopathological studies of the corneal tissue s/p RK indicate that corneal wounds never heal and the biomechanical characteristics of the cornea are permanently weakened
- Delayed wound healing

PERK Study[4]

The **Prospective Evaluation of Radial Keratotomy (PERK) Study** was published in 1994 as a 10-year prospective analysis of the long-term effects and stability of refractive error after RK. This study was designed as a 9-center clinical trial in the US using a standardized RK technique of 8 centripetal incisions to reduce myopia between -2.00 to -8.75 diopters. There were 427 patients originally enrolled in this study, with 374 (693 eyes) returning for 10-year follow up examination. The main finding of the study was that "the PERK technique of radial keratotomy eliminated distance optical correction in 70% of patients, with a reasonable level of safety". Of note, it was also found that after 1 year, 34% of patients reported difficulty with daily fluctuations in vision which persisted for as long as 11 years after surgery. Hyperopic shifts continued during the entire 10 years after surgery with 43% experiencing a shift of ≥ +1.00 D at 10 years.

Patient GS

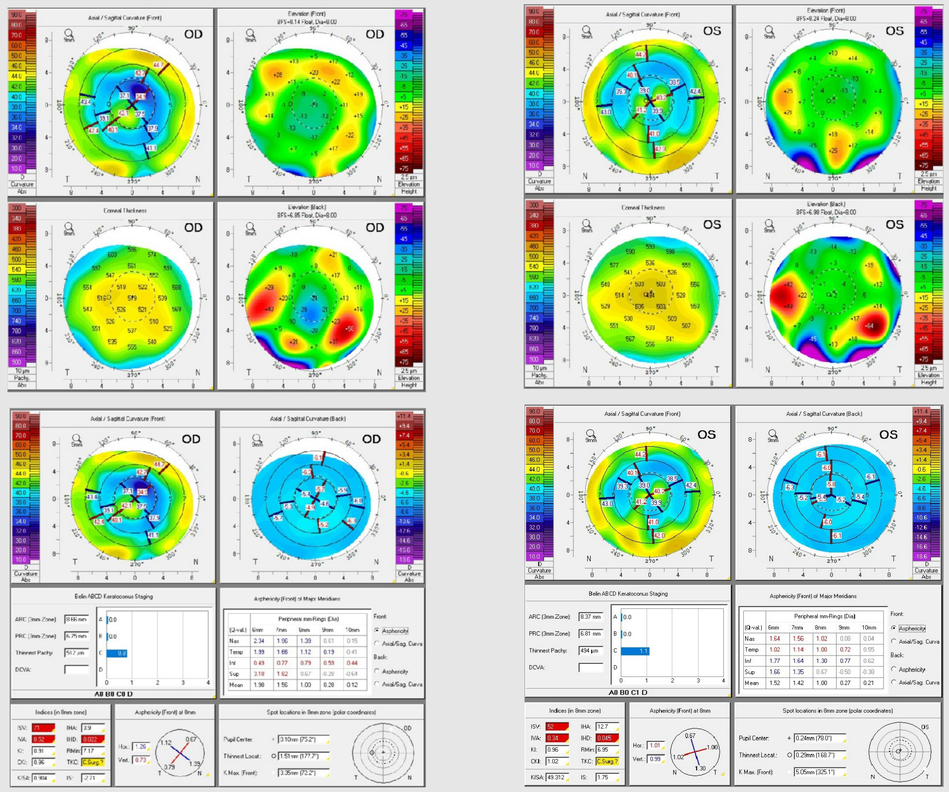
August 22, 2022
71 yo WF presents for specialty lens evaluation
- longstanding history of standard tricurve corneal GPs OU
- Wearing OD>>OS lens due to dryness and mild discomfort; not true pain, just some irritation

Ocular History
RK OU (1980s)
Dry eye syndrome, OU (artificial tears prn)

Visual Acuity (corneal GPs)
OD: 20/20-2
OS: 20/25+

	OD	OS
lids/lashes	Mild UL/LL laxity; 1+ inf papillary rxn	Mild UL/LL laxity; 1-2+ inf papillary rxn
conjunctiva/sclera	White and quiet	White and quiet
cornea	8 RK incisions; no ED; mild dryness	8 RK incisions with 2 horizontal upper/lower relaxing incisions with mild gape at 12/6 o'clock; no ED; mild dryness
anterior chamber	Deep and quiet	Deep and quiet
iris	Round and reactive	Round and reactive; small, flat pigmented nevus 7:30
lens	Tr+ NS	Tr+ NS

Pentacam Topography OU



Pentacam Review 09/07/2022

	K1	K2	Astig	K Max	PacVer	Pac Min	TKC
OD	38.0	38.1	0.1	47.1	519	512	s/p RK
OS	38.4	40.4	1.6	48.5	494	494	s/p RK

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Lens Fit

Contact lenses – corneal GPs OU
Replacement Schedule: current lenses 2+ years old
Average Wear Time: varies; 6-12 hrs/day
Wear Time Today: 6 hours
Solution: Boston Simplus; instills 1 drop ATs before removal
Sleeps in lenses: never
Other vision correction: no backup specs, uses OTC readers over CLs prn

BC	DIA	PWR	PC1	PC2
7.99	11.2	-0.25	??	??

mild central pooling with mid-peripheral bearing

[switched to reverse geometry]

BC	DIA	PWR	PC1	PC2
8.44	10.8	+2.00	7.8	9.63

lid attached with blink but tends to decenter slightly inferior nasally; mid-peripheral bearing with mild edge lift and adequate central clearance; patient has lens awareness/variations in vision with blink

[steepened reverse curve by 0.75 D and steepened edge by 0.50 D]

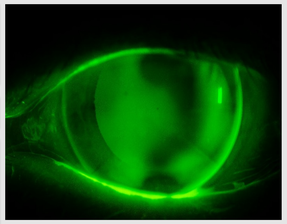
BC	DIA	PWR	PC1	PC2
8.44	10.8	+2.00	7.67	9.51

slight lens awareness per patient; lens decenters inferior nasally; lid attaches with some blinks; areas of touch/minimal clearance ~5:30 in mid-periphery of lens; good movement with blink/tear exchange; adequate edges 360

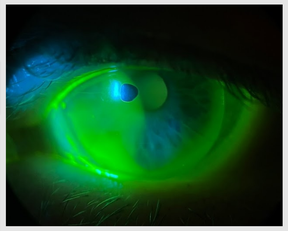
[steepened reverse curve by 1.00 D]

BC	DIA	PWR	PC1	PC2
8.44	10.8	+2.00	7.50	9.51

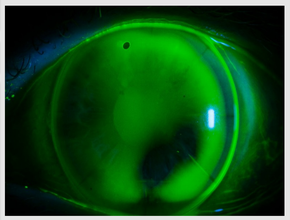
better alignment/centration/stability; small insertion bubble superior temporal mid-periphery ~2 o'clock that moves with the blink; feather touch over inferior temporal steep incision; good initial comfort and vision



Habitual lens OS 09/07/2022



Lens #1 OS 09/27/2022



Final lens OS 10/10/2022

Conclusion

Specialty contact lenses can help drastically improve post-RK patients' quality and stability of vision. Scleral lenses are often great options for these patients because they vault over the unstable and irregular corneal curvatures. In the case of this patient, it was very important to her that she remain in corneal gas permeable lenses. This was achieved by optimizing the fit, vision, and comfort of the lens by refitting into a reverse geometry design. If the cornea continues to change and there are changes to visual stability and/or comfort of lenses, a strong recommendation for a refit into scleral lenses is the next step.

References

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