Management of Secondary Complications in Post-Radial Keratectomy Patient

SOUTHERN COLLEGE OF OPTOMETRY
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INTRODUCTION

Radial keratotomy (RK) was first performed in the United States in 1978. It quickly gained popularity in the 1980s as a treatment for myopia to reduce patient dependence on spectacles. While initially deemed a safe surgery, the inherent variability in corneal incisions and healing led to secondary complications such as anisometropia, irregular astigmatism, and corneal scarring.[1,2] According to the Prospective Evaluation of Radial Keratotomy (PERK) study, 18% of RK patients lose one or more lines of best-corrected spectacle vision ten years post-surgery.[2] Contact lenses, with their ability to smooth over the irregular ocular surface and reduce aniseikonia, is often the treatment of choice for these patients.[1,3]

CASE HISTORY

A 48-year-old female presented for specialty lens fitting with chief complaints of halos, glares, and fluctuating vision that began soon after her RK surgery in 1989. Her symptoms have worsened over the last several years, causing her to reduce her outdoor activities due to glare not resolved by sunglasses. She does not wish to wear spectacles as they limit her active lifestyle. In fact, this reason drove her to seek a LASIK consultation with the referring corneal specialist. Her ocular history is also significant for dry eyes, and her medical history includes sleep apnea and seasonal allergies. She does not take medications.

PERTINENT FINDINGS

At the initial visit, the patient was found to be 20/20 OD and 20/20-1 OS through habitual spectacles *(Table 1)*. However, she complained of significant halo, shadowing, and glare while looking at the acuity chart. Anterior segment exam revealed eight partial-thickness radial scars on the cornea with 3.0mm clear central zone and stellate epithelial iron lines OU *(Figure 1)*. Topography found irregular astigmatism OU *(Figure 2)*.

TABLE 1: *Keratometry measurements and prescriptions of spectacles and contact lenses of the patient.*

	EYE	RX	DISTANCE VA
Keratometry	OD	Irregular 37.91@092/38.32@002	--
	OS	Irregular 37.51@160/38.87@070	--
Habitual	OD	+4.00-0.25x089 +2.00ADD	20/20
	OS	+3.50-1.50x162 +2.00ADD	20/20-1
Manifest	OD	+4.50-0.75x075 +2.00ADD	20/20
	OS	+4.25-0.75x147 +2.00ADD	20/20
Scleral	OD	Zenlens Oblate Toric PC: +3.50DS/4500SEG/16.0DIA/9.0BC/0.35CT, APSFlat3/Steep3	20/15
	OS	Zenlens Oblate Toric PC: +4.25DS/4700SEG/16.0DIA/9.5BC/0.35CT, APSFlat3/Steep3	20/15

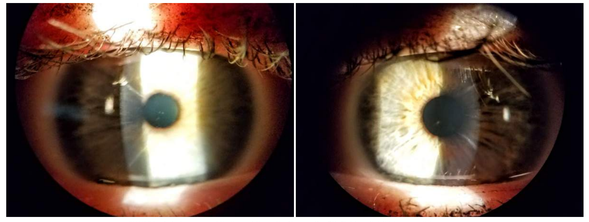

FIGURE 1: *Anterior segment findings of the patient's eye after RK. Eight partial-thickness radial scars are seen on the cornea with 3.0mm clear central zone and stellate epithelial iron lines OU.*

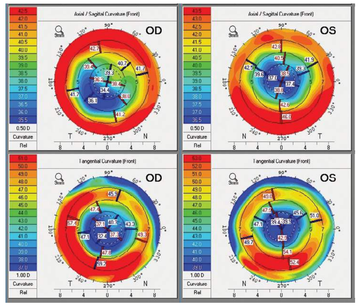

FIGURE 2: *Topography of the patient's corneas after RK. Pentacam measurements indicate central flattening and irregular astigmatism OU: OD: 37.91@092/38.32@002, OS37.51@160/38.87@070.*

TREATMENT AND MANAGEMENT

Based on her chief complaint, goals for lens wear, and exam findings, she was fitted with scleral lenses in an oblate design *(Figure 3)*. At dispense, she was 20/15 OD and OS, and she observed an immediate reduction in halos, glares, and shadowing of images in her vision. She noted significant improvement in her quality of vision and that she was able to enjoy her hobby of playing golf again at follow up.

FIGURE 3: *Anterior segment photo of the patient wearing scleral lenses. Zenlens Oblate designs are well centered in both eyes with corneal and limbal clearance.*

DISCUSSION

RK is a surgical procedure in which partial-thickness radial incisions are made in the paracentral cornea to flatten the central radius of curvature, thereby reducing myopia.[1,2] With the advent of newer refractive surgeries that optimize outcome and minimize complications, RK has become less commonly performed over the last few decades.[1,3] Many complications have been reported with RK.[1]

- Corneal perforations
- Microbial keratitis
- Non-healing corneal defects
- Endothelial cell loss
- Epithelial basement membrane changes
- Recurrent corneal erosion
- Cataract
- Keratotomy scar rupture
- Epithelial ingrowth
- Iridocyclitis
- Ptosis

Refractive complications and visual problems following RK are the most common complaints after RK. In the case of our patient, she suffered from visual distortions, photophobia associated with disability glare, diurnal changes, irregular astigmatism, and overcorrection.

- Visual distorts in for the form of halos, glares, and monocular diplopia are common phenomenon after RK surgery, often related to refractive error shift or irregular astigmatism *(Figure 4)*.[1,4]
- Photophobia is associated with 2% of cases after the first year of surgery in a study of 105 cases.[1,5] Patients generally reported a starburst pattern much like the scars on their cornea when observing a single light source *(Figure 4)*.[1] The PERK study found 0.6% of patient with disability glare at night one year after surgery.[1,6]
- Diurnal fluctuation is a common persistent side effect of RK.[1-2] The PERK study reported that one-year following surgery, 42% of patients experience 0.50D or greater myopic shift from morning to evening, which is an increase from 34% in the 3-month result.[1] The shift in refractive error is attributed to mild corneal edema and constant pressure of the eyelids at night interacting with the change in the structural integrity of the corneal after surgery.[1,7]
- Irregular astigmatism is found in all patient after RK in varying qualities. It decreases best-corrected spectacle visual acuity and produces glare and halos. It can be masked with gas permeable contact lenses.[1,3,8-10]
- Overcorrection mostly commonly results from a continued hyperopic refractive change in patients years after surgery.[1] According to the PERK study, the mean refractive error changes from -0.36D at six months to +0.50 D at ten years in the hyperopic direction. A change of 1.00D or more hyperopic shift occurred in 43% of eyes ten years after surgery. As was in the case of our patient, 0.3% of eyes were measured to be ≥4.00D at one year, 1.0% at four years, and 1.3% at ten years.[2]

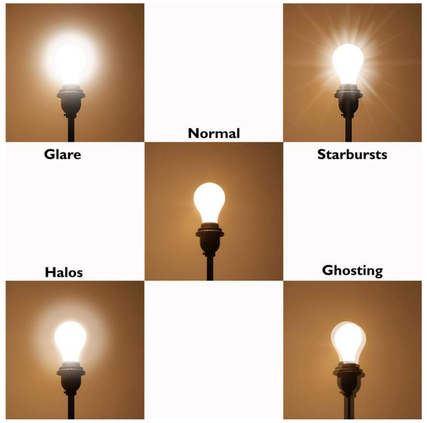

FIGURE 4: *Visual distortion commonly found following refractive surgery.*[1]

All of our patient's complaints except for the diurnal changes in refraction significantly improved with her new scleral lenses. Other complications of RK that can be mitigated by corneal or scleral gas permeable lenses include:[1,3,8-10]

- Undercorrection
- Anisometropia
- Residual or induced astigmatism
- Reduced contrast sensitivity
- Monocular diplopia
- Irregular corneal scars
- Symptoms of corneal ectasia

Many challenges are associated with fitting contact lenses in patients following RK due to their flat topography and corneal scarring *(Figure 5)*.[3,8-10] The reemergence of scleral lenses, with their ability to vault over the cornea entirely, has played a significant factor in improving the quality of life for these patients.

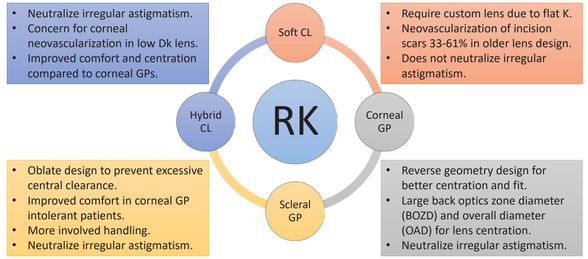

FIGURE 5: *Considerations for Contact Lens Fitting after RK.*

CONCLUSIONS

Rigid Contact lenses are often the treatment of choice in patients with reduced vision status post-RK. Even for those who maintain 20/20 through spectacles, the poor visual quality can be debilitating to their everyday activities. Scleral lenses are an effective treatment option for these patients to improve their quality of life.

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