

## Background

The fitting of contact lenses in eyes which have undergone full thickness penetrating keratoplasty (PKP) is a challenging task when the corneal topography is greatly altered in the area of the graft wound. However, the outcome can be very rewarding because of the potential to significantly improve visual function.<sup>1,2,3</sup>

Although scleral lenses have become increasingly popular for challenging cases as they vault the entirety of the irregular corneal surface,<sup>4,5</sup> the approach taken in this case was to approximate the corneal shape using a reverse geometry design corneal rigid gas-permeable lens. The added benefit of using a corneal rigid gas-permeable in high Dk material instead of a scleral lens is that oxygen transmission can be maximized with lens movement and tear flow under the lens.

This consideration is important for the post PKP cornea, because in comparison to normal corneae, it is more susceptible to complications under hypoxic conditions secondary to the resultant decreased endothelial cell density.<sup>6,7,8</sup>

## Case Description

A 71 year old Caucasian female with a history of keratoconus was referred by her primary care optometrist for contact lens fitting. Ocular history was significant for bilateral PKP OD/OS in 1974/1973, second PKP OD/OS in 2000/1991 following graft rejection, DSAEK OD in 2010 and bilateral cataract extraction OD/OS in 2001/2003.

She had previously been fitted with PMMA contact lenses and discontinued in 1995 due to lens intolerance following a corneal infection in 1994. She was now motivated to return to contact lens wear since her best corrected spectacle acuity no longer allowed her to meet the driving requirements; which is having a visual acuity of 20/50 when viewing binocularly.

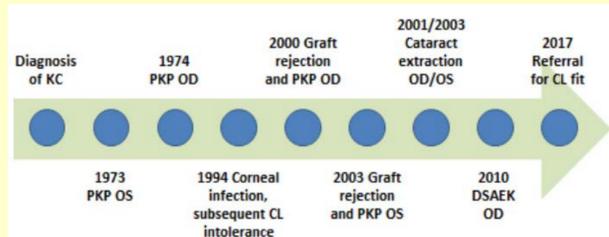


Figure 1: Timeline of Ocular History

## Initial Examination Findings

Corneal topography using Pentacam® was acquired prior to diagnostic contact lens fitting to aid in initial lens selection. Pentacam® scans revealed simulated K readings of 47.7 D @ 81.6° and 53.8 D @ 171.6° (6.1 D of corneal cyl) in the right eye. The left eye had simulated K readings of 45.8 D @ 54.4° and 51.1 D @ 141.1° (5.3 D of corneal cyl). Corneal thickness at pupil center was 985um and 656um in the right and left eyes respectively.

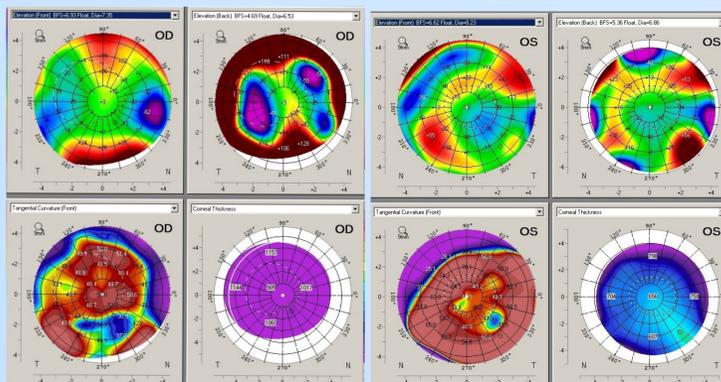


Figure 2: Pentacam Scan OD

Figure 3: Pentacam Scan OS

Anterior segment examination of the right eye by slit lamp revealed PKP with neovascularization approaching the graft host junction at 4 o'clock, multiple endothelial folds, and mild corneal edema and clouding. Anterior segment examination of the left eye revealed a clear PKP with neovascularization approaching the graft host junction at 6 o'clock and 4 o'clock, pigment on the endothelium, sutures at 6 and 3 o'clock. Both eyes had anterior chambers which were deep and quiet as well as clear and centered PCIOLs.

Subjective refraction was found to be -0.75/-5.50 x 035 in the right eye and -2.75/-3.00 x 80 in the left eye with a +2.50 add. Best corrected spectacle VAs were 20/70 OD and 20/70 OS.

Medical history was significant for RA, Crohn's disease, prolapsed bladder, seasonal affective disorder; controlled with the following medications: Remicade injections q6weeks, citalopram 10mg, domperidone 20mg, loperamide 2mg, naproxen 5mg, bifidobacterium, lansoprazole 30mg, quentapine 100mg. In addition, current eye drops include 1 gtt flurometholone 0.1% solution BID OU and 1 gtt Systane Hydration BID OU

## Diagnostic Contact Lens Fitting

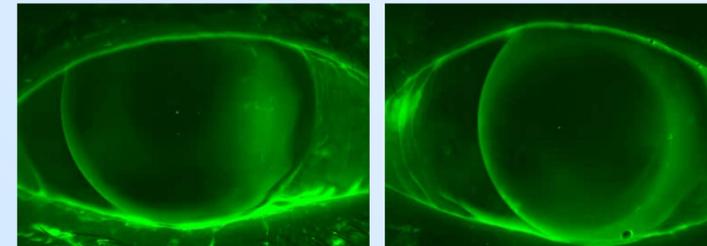


Figure 4: PK4 OD (flat fit)

Figure 5: PK4 OS (flat fit)

	Supplier	Lens Type	Lens Name	BC	Diameter	Power
OD	AVT	Reverse Geometry Corneal GP	PK4	7.76	10.5	Plano
OS	AVT	Reverse Geometry Corneal GP	PK4	7.76	10.5	Plano

A reverse geometry rigid gas permeable lens was chosen to best align with the oblate shape of the cornea, which is flat central and steeper peripheral corneal topography. A large diameter (10.5mm) was indicated to improve lens stability and centration by allowing an even distribution of weight over the transplanted corneal surface. The PK4 corneal gas-permeable lens (Advanced Vision Technologies) was selected for diagnostic lens fitting, providing a 4D difference between the central base curve and peripheral curves to effectively reduce clearance over the graft and allow increased clearance over the mid-peripheral cornea. Resulting visual acuities were 20/50<sup>-3</sup> and 20/25 in the right and left eyes respectively with over-refraction. Lens material chosen was Acuity 100 with a Dk value of 100.

## Final Contact Lens Dispense

	Supplier	Lens Type	Lens Name	BC	Diameter	Power
OD	AVT	Reverse Geometry Corneal GP	PK4	7.13	10.5	-2.75
OS	AVT	Reverse Geometry Corneal GP	PK4	6.86	10.5	-6.75

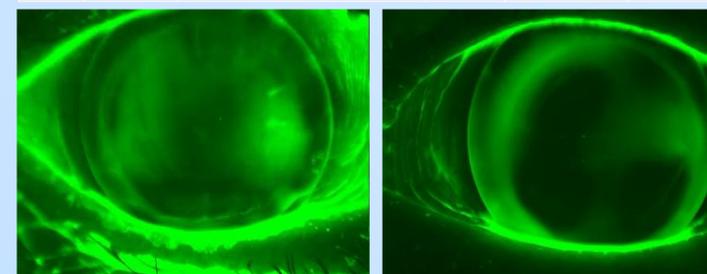


Figure 6: PK4 OD (final fit)

Figure 7: PK4 OS (final fit)

## Discussion

Various factors, including corneal physiology and corneal topography, were taken into consideration for contact lens selection in this case because the patient's history was significant for multiple ocular surgeries. Without access to a specular microscope, the literature can be used to predict the effect of ocular surgeries on endothelial cell count (ECC). As transplanted corneas age and the number of endothelial cells decreases, the cornea thickens because of decreased endothelial cell function.<sup>8</sup> The average ECC was found to be 803 cells/mm<sup>2</sup> in corneal transplants 20 years old or more.<sup>7</sup> This count is significantly less than the normal adult 70-74 years with an ECC of 1800-2600 cells/mm<sup>2</sup>.<sup>7</sup> ECC also decreases at an average rate of 2.5% per year following cataract surgery.<sup>8</sup> It is important to consider that for the post PKP cornea, it is more susceptible to complications under hypoxic conditions secondary to the resultant decreased endothelial cell density compared to normal corneae. In addition, the corneal topography after PKP is greatly altered in the area of the graft wound and typically oblate in shape. The topography is highly irregular and 40% of corneal transplants 20 years or older develop peripheral corneal thinning and ectasia.<sup>7</sup> Other patient factors should be considered including manual dexterity for lens handling and financial cost. Both corneal GP lenses and scleral lens have been used successfully to improve visual function after PKP. However, a reverse geometry corneal GP in high Dk material was selected in this case in order to maximize oxygen transmission to the cornea by allowing increased tear exchange under the lens. The reverse geometry design was successfully fit by approximating the corneal contour and masking corneal irregularity thereby improving visual acuity.

## Conclusions

- ❖ Reverse geometry corneal gas-permeable lenses in high Dk material are beneficial for correcting astigmatic and anisometric refractive errors after PKP.
- ❖ The tear fluid exchange that occurs with gas-permeable corneal contact lenses allows for greater oxygen transmissibility in comparison to other modalities making it an excellent consideration for post PKP corneae that are already compromised.<sup>2,4</sup>

## References

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