



# The use of a novel new oblate semi-scleral contact lens design for fitting a protruding and tilted penetrating keratoplasty

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## Background:

Quite often a full thickness penetrating keratoplasty will sit forwards from the host tissue ("proud"), generating a corneal shape that is flatter over the graft and steeper outside the graft, producing a reverse geometry graft-host junction. For an optimal lens fit, it is therefore preferable to have a lens design where the mid-peripheral curves immediately outside the back optic zone are steeper than the base curve, making the lens an oblate design.

An oblate semi-scleral lens design (the ROSE K2 XL Oblate) should provide a more accurate and comfortable fit over these shaped corneas, than the more common prolate designs.

## Case Description:

Patient DC, a 52YO male web designer, was referred by a colleague in 2016 for a refit of a healthy 20YO RE penetrating keratoplasty, which was sitting proud of the host cornea and was significantly tilted, making it elevated nasally and causing a steep "drop off "zone in the nasal-inferior quadrant. (Fig 1)

The graft had presumably steepened over time, causing a standard rigid lens fit to become unstable, and the patient had been making do with a soft toric CL which was now only giving a BCVA of 6/18. After initially successfully refitting the RE with a hybrid CL (BC = 7.1), this too eventually became unstable and uncomfortable, with a fluting soft skirt. With the help of an Oculus Pentacam <sup>TM</sup> tomographer, the corneal elevations could be visualised at the graft-host junction, and the patient was successfully refitted with a new ROSE K2 XL Oblate semi-scleral lens.

## Five-step fitting process:

### Step 1: Base Curve (BC) selection

As per the fitting guide, the initial lens BC was selected from the Pentacam<sup>TM</sup> graft apex tomographies: 7.31/7.01mm (mean K = 7.16) (Fig 1). The graft exhibited only about 2D of corneal astigmatism. The fitting guide indicated initial BC = mean K plus 0.3 = BC 7.46. So we estimated the first BC to be 7.4 and ordered a lens based on the oblate trial lens set:

**ROSE K2 XL Oblate BC 7.4 / Diam 15.0 / -5.75D with -1.50 Dec lift**

However, when this lens was dispensed, it was uncomfortable to the patient and looked too flat over the elevated nasal graft-host junction, and we also wondered if the flat-fitting hybrid lens worn into the fitting appointment had moulded the cornea to give us a false tomography reading.

A trial lens of BC 7.2 was then tried and showed adequate lens clearance over the whole graft apex after 20 mins settling time but only minimal clearance of 50 microns nasally on the anterior OCT (Fig 2). However, this BC 7.2 provided a good "black" landing zone band, just inside the limbus, of between 1.0 to 1.5mm wide (Fig A). To add slightly more clearance in the raised nasal aspect, we decided to make the next BC 7.1.

### Step 2: Peripheral fit

With the BC 7.2 trial lens still in situ, and observing the fluorescein pattern outside the limbus at all positions around the clock, we aimed for a shallow and even fluorescein band of about 0.8 to 1.0mm wide. In this case it was nearly symmetrical all the way around with a "standard lift" trial lens, so no adjustments were necessary. (Sometimes a toric or asymmetric periphery may be required, but a slightly asymmetric fitting periphery can aid tear exchange behind the lens).

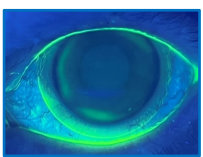
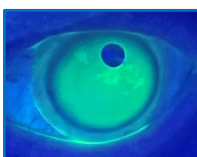


Fig A. Example of (left) an ideal even limbal landing zone and edge lift on a RK2XL oblate lens fitted to a more regular post-radial keratotomy cornea. On the right is the same lens inserted incorrectly by the wearer with an air bubble under it, which always distorts the vision. Also note a mucus build-up under this lens worsening by late afternoon, a fairly common complication.



### Step 3: Diameter

In this case the standard diameter trial lens (14.6mm) was fractionally too small, so we went to a 15.0mm diameter for the final lens to marginally improve the peripheral fit bandwidth.

### Step 4: Location

The BC 7.2 / 14.6mm trial lens sat evenly around the limbus, despite the fact that the graft was tilted. The final diameter of 15.0mm was also expected to help with this.

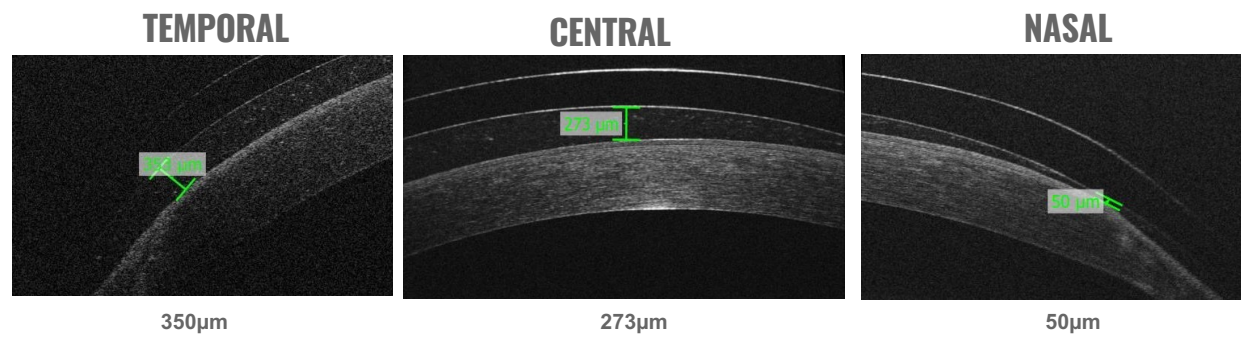
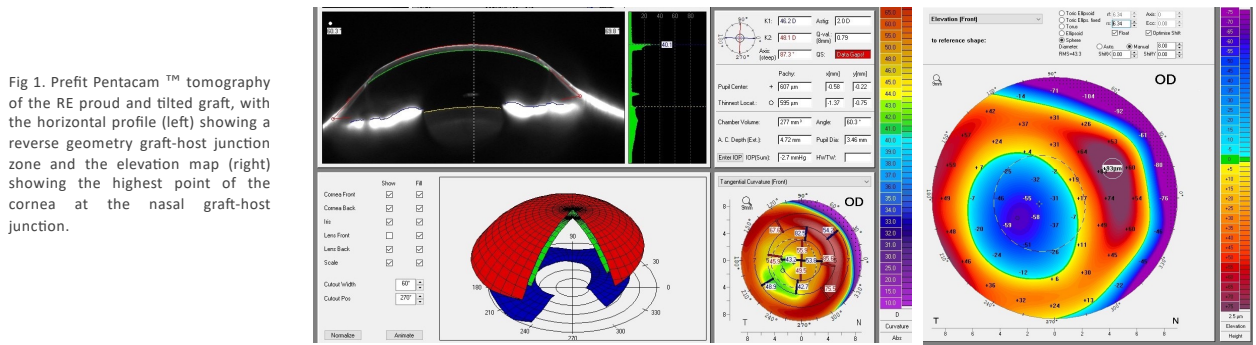


Fig 2. Composite anterior OCT of the BC 7.2 RK2 XL Oblate trial lens over the tear film and cornea immediately after insertion. Because the graft is tilted, there is significantly less corneal clearance at the nasal aspect of the graft junction (50 µm) which will be problematic, so a steeper BC of 7.1 was eventually selected to overcome this.

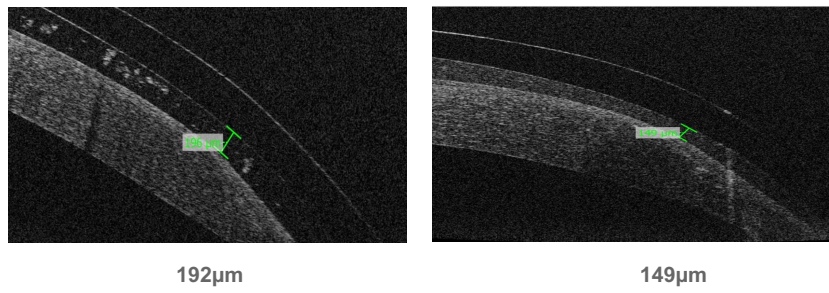


Fig 3. Anterior OCT of nasal clearance with the final selected BC 7.1 RK2 XL Oblate lens, showing (left) clearance of 192 µm after 20 mins at the collection appointment and (right) maintained clearance of 149 µm at the first 2-week aftercare, after 6 hours of wear.

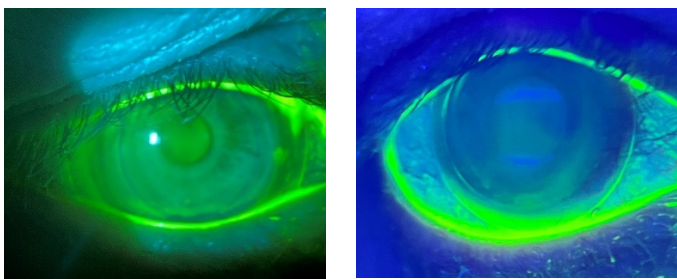


Fig 4. Fluorescein patterns of the final BC 7.1 post-graft oblate fit at 20 mins collection (left), and after 14 weeks wear (right) demonstrating less fluorescein pooling nasally, good centration and with some tear exchange behind the lens.

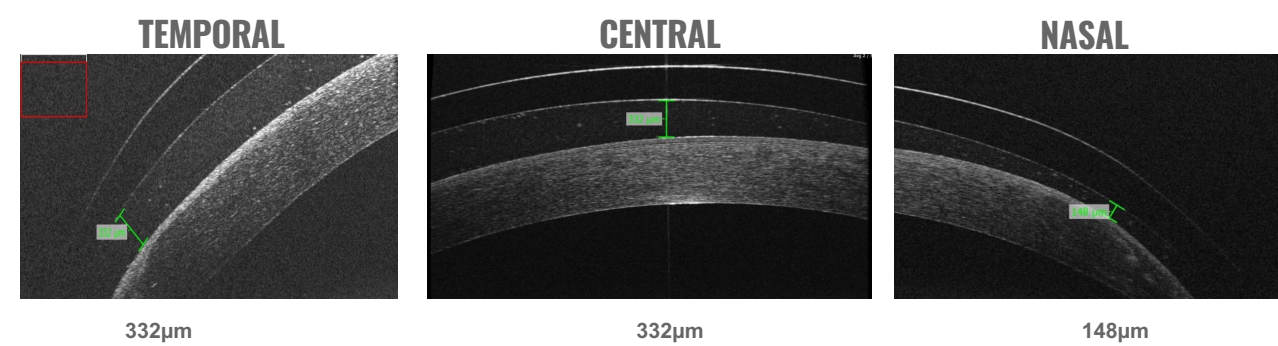


Fig 5. Composite OCT of the worn BC 7.1 RK2XL oblate lens at the November 2022 aftercare with good central and temporal clearance, and maintained adequate nasal corneal clearance of 148 µm as hoped.

### Step 5: Movement

On first insertion, the trial lens moved about 0.5mm on blinking. After allowing for a 20 minute settling time the central, paracentral and peripheral fit and movement was again checked with fresh fluorescein, and the movement had reduced to "just discernable" with some tear exchange, especially through the vertical meridian (Fig 4).

### OCT fit analysis:

Because the graft was tilted, the highest point of the cornea was nasal and this had to be cleared by the lens at all times (Fig 1). Thus the BC 7.2 trial lens easily cleared the cornea centrally and temporally but was still marginally flat nasally (Fig 2). Steepening the BC by a further 0.1mm to 7.1 gave a safer nasal lens clearance (Fig 3).

FINAL LENS (ISSUED JULY 2022): **RK2 XL Oblate BC 7.1 / Diam 15.0 / -7.75 / Std lift**

Acuity 200 material; BCVA 6/9+

## Collection visit:

The lens showed adequate clearance of the nasal cornea with both the fluorescein pattern (Fig 4) and OCT images (Fig 3). Visual acuity was 6/7.5 (20/25) with a negligible over-refraction. The patient had to be taught how to firmly insert the lens filled to the brim with saline, to avoid air bubbles (Fig A). The patient was asked to build up lens wear by 2-3 hours a day over the first 2 weeks and to report back sooner with any obvious early comfort or vision issues.

## Aftercare visits:

After 2 weeks the patient returned, having already worn the lens for 6 hours that day. He was very happy with comfort and vision so far, which had been steadily improving. Before removing, anterior OCT's were taken of the lens in situ to ensure continued nasal corneal clearance (Fig 3). It could be seen that compared to the 20 minute collection OCT scans, the lens had now settled slightly closer to the cornea in the nasal aspect by about 40 microns (Fig 3). After checking vision (6/7.5; no significant over-refraction), the lens was removed without excessive suction and fluorescein staining revealed no corneal or limbal issues, especially at the nasal high point of the cornea.

Subsequent aftercare visits in late July, September and November 2022 confirmed no corneal complications despite the lens still bearing more on the nasal aspect of the cornea. Occasionally the patient would get double vision upon insertion due to retained air bubbles, and occasionally experienced some transient mucus trapped under the lens by late afternoon, which could be cleared by using lubricant drops (Fig A). Tear circulation could be seen under the lens. The lens was slightly tighter along the horizontal meridian than vertically (Fig 4), but not deemed enough to justify changing to a toric periphery. The patient was still very happy and can wear the lens for up to 14 hours/day. BCVA was consistent at 6/9+ with no significant over-refraction. Fig 5 shows the composite anterior OCT scans for the November 2022 aftercare showing consistent continued lens clearance, especially nasally.

## Conclusions:

There is a place for an oblate semi-scleral lens design such as the ROSE K2 XL Oblate for more accurately fitting proud corneal grafts and other oblate post-surgical corneas such as post-radial keratotomy and post-LASIK ectasia. Anterior OCT images can also assist with refining the fitting process, especially if the graft is tilted. Lens BC selection can be significantly affected based on the highest elevation of the cornea to maintain tear film clearance.

**Affiliations :** The author (GW) is a part-time non-paid independent consultant for Menicon.

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