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Successful RGP fitting in a 29-year-old high-myopic man

ABSTRACT

Individuals with high myopia often experience several challenges, including a reduced perceived image size, heavy spectacle frames and lenses, compromised visual quality, and cosmetic concerns. Contact lenses can provide an effective solution to address these issues.

INTRODUCTION

The prevalence of myopes and astigmatism in Hong Kong was 43.6% and 42.9% (HKSAR, 2020). The optical management of high myopia presents challenges. Spectacle correction for significant myopia induces minification of the retinal image, a phenomenon known as spectacle magnification (SM). This minification can reduce best-corrected visual acuity. Contact lenses offer an optical solution for high myopia as they sit on the cornea which help eliminate minification and maintain a large retinal image size, potentially improving acuity. However, the choice of correction must also consider ocular surface health. Dry eye disease is a common comorbidity that can significantly affect tolerance to any contact lens. RGP lenses can offer an advantage for some dry eye patients by allowing tear exchange compared to soft lenses.

CASE PRESENTATION

Comprehensive eye exam

NAME: T.K.C.N **Age 29**
EXAM DATE: 2025-08-20

1st eye check/ Last Eye Exam*: 2024-01-20
Routine Eye Check ~~/~~ **Others:**
Patient would like to have contact lens.

Personal ocular health:

✓ Unremarkable (No Floaters & flashes, no inflammation/surgery/ trauma before)

Others:

Personal general health:

✓ Unremarkable
Hypertension DM Hyperlipidemia
Heart disease
Others:

Family ocular health:

Unremarkable

✓ Macula Disease Glaucoma Retinal Disease
Parental refractive error: Father Mother

Allergy

No known drug allergy Allergic rhinitis

✓ Eczema Asthma

Others:

Medication:
Isotretinoin for acne

HABITUAL RX	~~S~~pec	C/L	Since 2025-01
RE	-8.25/-1.00 x 020		VA
LE	-7.00/-1.50 x 158		VA

Axial Length

Objective Refraction	RE	**-9.00/ -0.50 x 030**	RE	27.67	mm
(~~Retinoscopy~~ / Auto-Ref*)	LE	**-8.25/-2.00 x 138**	LE	27.63	mm

Subjective Refraction

	SPH	CYL	AXIS	DVA	R/G	+1Blur	Prism	PD		
RE	**-8.00**	**-1.00**	**028**	**1.2+**				**Dist**	32.5	/ 32
LE	**-7.00**	**-1.50**	**136**	**1.2+**				**Near**		/

Anterior Eye

Anterior segment: Biomicroscopy	
Lids/Lashes	Clear OU
Cornea	G1 depth and G1+ area patchy staining inferior OU
Tear quality	Unremarkable OU, TBUT: 6-7s OU
Conjunctiva	Clear, no papillae OU
Iris	Flat OU
Lens	Clear OU
Anterior chamber	Deep and quiet

The patient was diagnosed with high myopia in both eyes, as indicated by the significant refractive error and elongated axial length. He was also diagnosed with bilateral dry eye, most likely associated with his systemic use of Isotretinoin.

The procedure, advantages, and potential risks of LASIK and other surgical options for myopia correction were explained in detail. After understanding the associated risks and concerns regarding long-term stability, the patient expressed reduced interest in surgical intervention but remained keen to explore alternatives to spectacles due to their weight and associated discomfort. Soft contact lenses were discussed as a potential option. However, the patient's ongoing Isotretinoin therapy was recognised as a major contributing factor to his dry eye condition. He also reported a previous unsuccessful experience with ACUVUE Oasys daily disposable lenses, which he was unable to tolerate beyond mid-day due to dryness and discomfort.

Given the patient's high refractive error and oblique astigmatism, no suitable daily disposable soft contact lenses are currently available in Hong Kong. Alternatives, including custom soft lenses, monthly disposable toric lenses, and rigid gas permeable (RGP) lenses, were discussed. Due to the significant ocular surface dryness, monthly soft lenses were considered likely to replicate or exacerbate previous discomfort. RGP lenses were therefore recommended as the most appropriate option, as their rigid design maintains a tear reservoir behind the lens, promoting optimal oxygen

transmission and tear exchange, which is beneficial for managing dryness and providing clear, stable vision.

In conjunction with lens selection, Systane Hydration was prescribed to be used 4 times daily, seven days a week, to improve ocular surface health. The patient's ocular condition will be re-assessed when the RGP lenses are ready for dispensing.

Lens Fitting and Inspection

K-Reading by OCULUS topographer										
RE	Flat K	7.97 (42.3)	@	16.5	Steep K	7.80 (43.3)	@	106.5	HVID	11.46
LE	Flat K	8.12 (41.6)	@	148.8	Steep K	7.90 (42.7)	@	58.8	HVID	11.60

To ensure accurate keratometry for RGP lens selection, corneal topography was performed bilaterally to obtain precise K values. The results showed corneal astigmatism of 1.0 D in the right eye and 1.1 D in the left eye, which closely corresponded with the spectacle refraction. As corneal toricity was less than 2.0 D, a toric lens design was not considered appropriate in this case.

Ocular refraction was calculated as follows: (d=5mm)

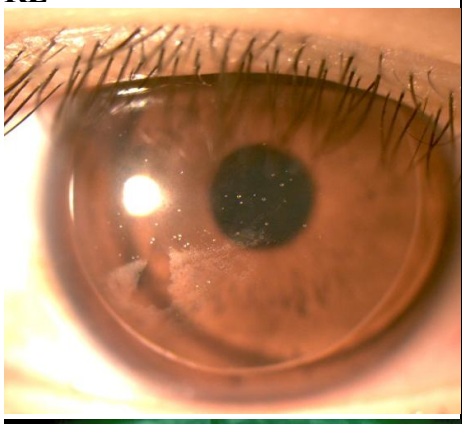
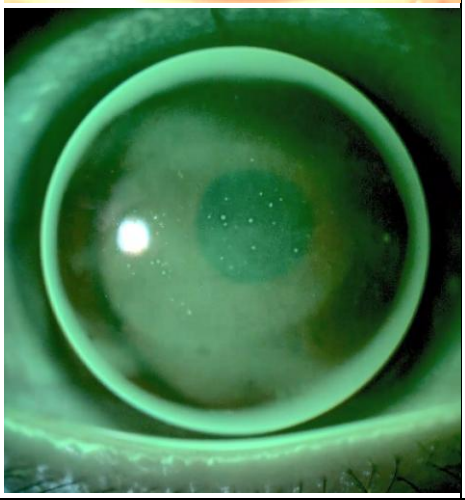
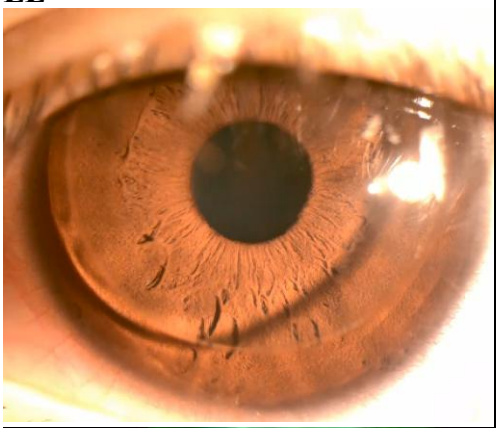
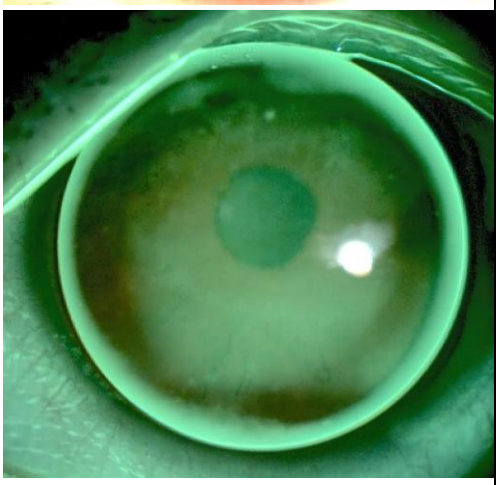
RE: -7.69/-0.92x028

LE: -6.76/-1.39x136

(Calculated using the formula $F = Fs / (1 - d \times Fs)$)

To facilitate accurate lens fitting and minimise reflex tearing, one drop of 0.5% proparacaine hydrochloride was instilled into each eye.

1st fitting

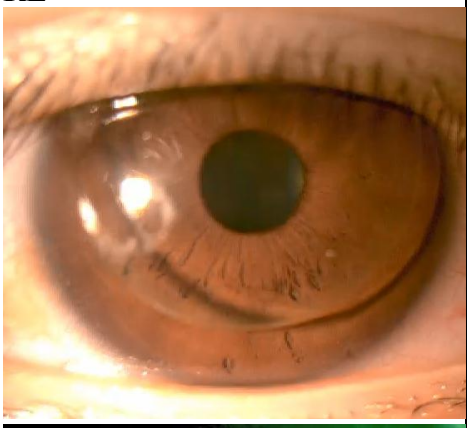
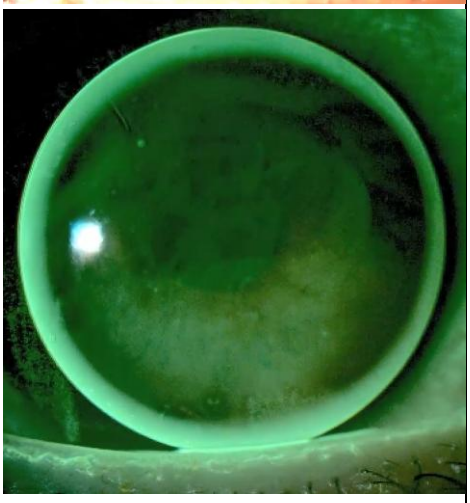
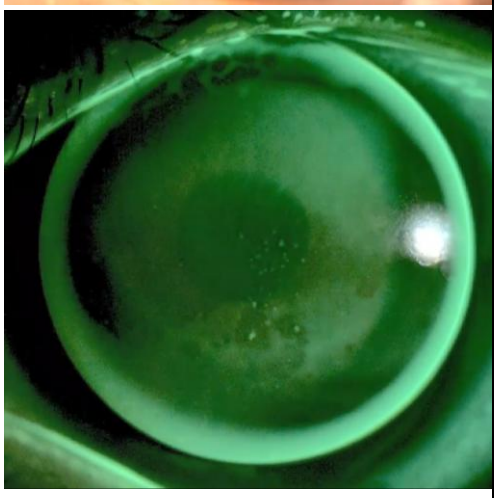
RE		LE
 		 
Oculus Achievement XO	Company/Brand/Material	Oculus Achievement XO
-3.00 BC 7.9 DIA 9.3	Lens parameter	-3.00 BC 8.0 DIA 9.3
Good centration With lid attachment	Centration	Good centration With lid attachment
Adequate 1mm	MOB	Adequate 1mm
Slightly pooling	Central Zone	Slightly pooling
Alignment	Mid-peripheral Zone	Alignment
Adequate	Edge	Adequate
-5.50 (1.2++)	O/Rx (VA)	-4.50 (1.2++)
Slightly steep fit	Lens comment	Slightly steep fit

The fluorescein pattern revealed slight central pooling in both eyes, indicating a slightly steep fit and the need for flatter lenses. Based on the ocular prescription, −4.50 D OD and −3.75 D OS were determined to be necessary to compensate for the lower power of the trial lenses, assuming an

optimal fit was achieved. The requirement for additional minus power in the over-refraction for both eyes further supported the presence of a steep lens fit.

Consequently, flatter lenses with base curves of 8.0 mm for the right eye and 8.1 mm for the left eye were selected for the next trial.

2nd fitting

RE		**LE**
 		 
Oculus Achievement XO	Company/Brand/Material	Oculus Achievement XO
-3.00 BC 8.0 DIA 9.3	Lens parameter	-3.00 BC 8.1 DIA 9.3
Adequate centration With lid attachment	Centration	Adequate centration With lid attachment
Adequate 1mm	MOB	Adequate 1mm
Alignment	Central Zone	Alignment
Alignment	Mid-peripheral Zone	Alignment
Slightly excessive	Edge	Slightly excessive
Mild lens sensation	Comfort	Mild lens sensation
-4.50 (1.2++)	O/Rx (VA)	-3.50 (1.2++)

Optimal fit	Lens comment	Optimal fit

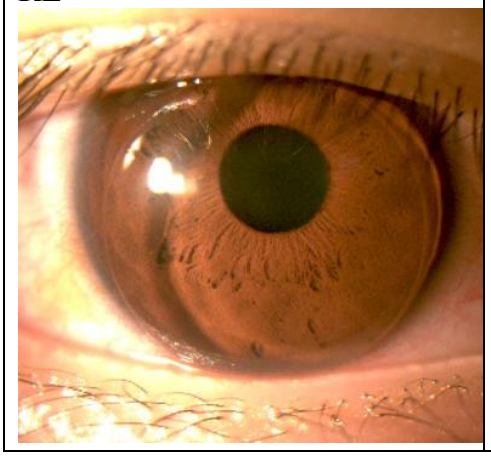
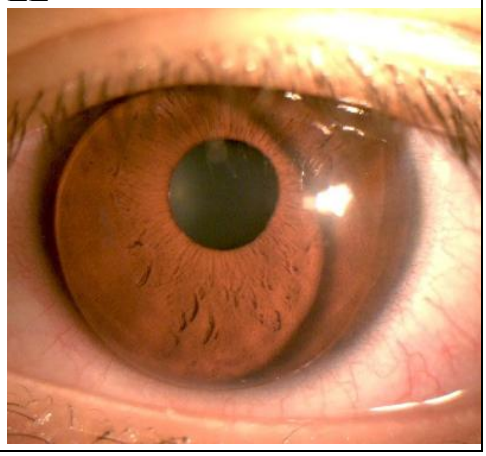
An optimal fit was achieved during the second trial fitting, as confirmed by the observed fluorescein pattern. The over-refraction findings further supported this assessment. The final lens order was therefore as follows:

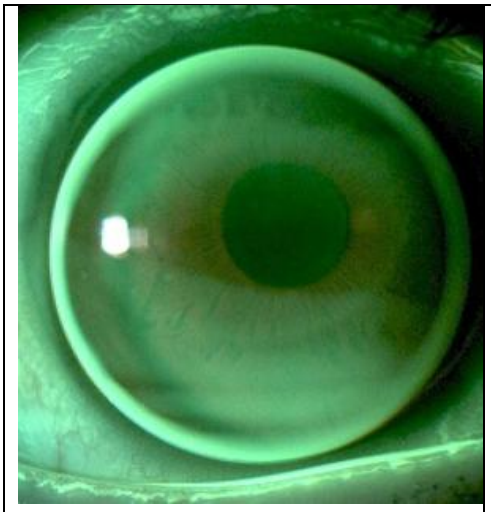
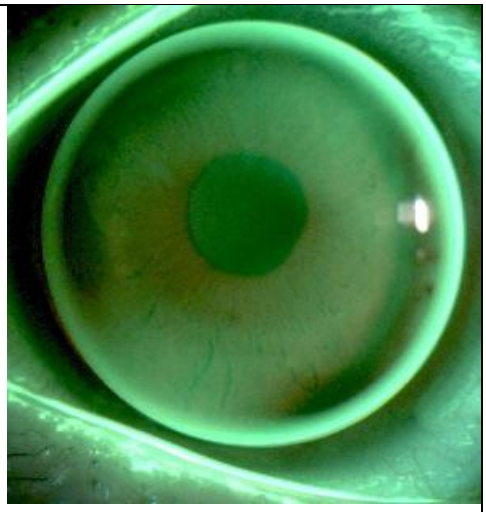
Lens order					
	Product name	Parameters	Diameter	Material	Color
RE	Oculus Achievement	-7.25 BC 8.0	9.3	XO	GREEN
LE	Oculus Achievement	-6.50 BC 8.1	9.3	XO	VIOLET

1st Lens delivery

Slit-lamp Biomicroscopy:

Anterior segment: Biomicroscopy	
Lids/Lashes	Clear OU
Cornea	Clear OU
Tear quality	Unremarkable OU, TBUT: 5s OU
Conjunctiva	Clear, no papillae OU
Iris	Flat OU
Lens	Clear OU
Anterior chamber	Deep and quiet

RE		**LE**
		

		
Oculus Achievement XO	Company/Brand/Material	Oculus Achievement XO
-7.25 BC 8.0 DIA 9.3	Lens parameter	-6.50 BC 8.1 DIA 9.3
Adequate centration; Interpalpebral	Centration	Adequate centration; Interpalpebral
Adequate 1.0mm movement	MOB	Adequate 1.0mm movement
Alignment	Central Zone	Alignment
H: Alignment V: Slightly pooling	Mid periphery Zone	H: Alignment V: Slightly pooling
Adequate	Periphery Zone	Adequate
Mild lens sensation	Comfort	Good comfort
1.2--	VA	1.0+
-0.25 (1.2)	O/Rx (VA)	-0.25 (1.2--)
Optimal fit	Lens comment	Optimal fit

Based on the fluorescein pattern and visual acuity, an optimal fit was deemed to have been achieved. The lenses were dispensed to the patient, who was advised to gradually increase wear time, starting with 4 hours on the first day and extending by approximately 2 hours each day until full-day wear is reached.

Menicare Spray & Clean was recommended for lens cleaning, with emphasis placed on the importance of proper lens rubbing. The patient was instructed to use Menicare Plus for overnight lens storage and to rinse the lenses with saline solution before insertion.

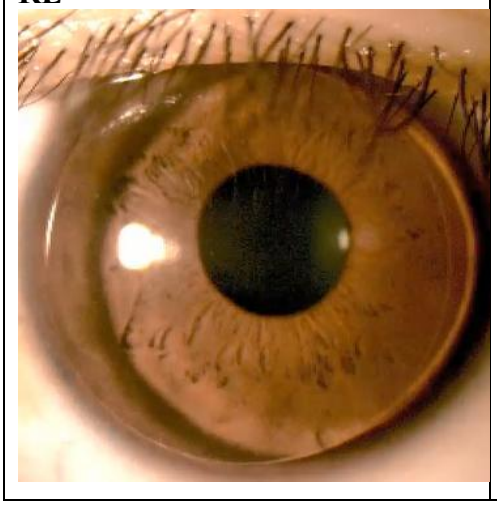
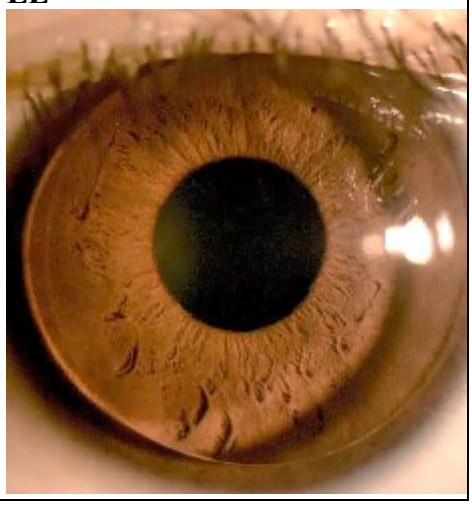
Insertion and removal training was provided, during which the patient demonstrated good understanding and was able to handle the lenses independently.

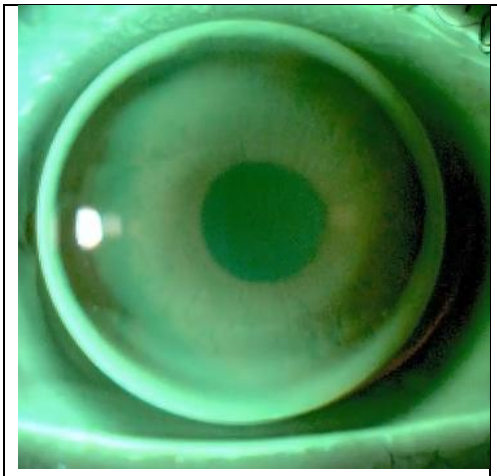
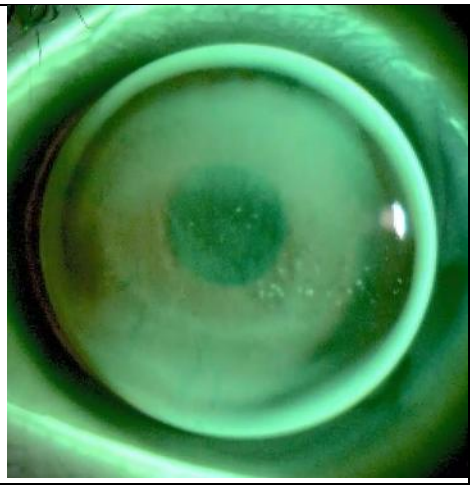
The 1ST week follow up

Wearing schedule:	10AM -10PM	Time of visit: 4PM	
Time of lens wearing	10 AM		
Insertion: Self		good	
Removal: Self		good	**Chief complaints:** Vision was satisfactory but not as clear as previously reported. The patient noted that the right lens frequently slid downward.
Lens caring: Self		good	
Lens care regimen:	Menicare plus + Menicare spray and clean + Saline		

Slit-lamp Biomicroscopy:

Anterior segment: Biomicroscopy	
Lids/Lashes	Clear OU
Cornea	Clear OU
Tear quality	Unremarkable OU, TBUT: 7s OU
Conjunctiva	Clear, no papillae OU
Iris	Flat OU
Lens	Clear OU
Anterior chamber	Deep and quiet

RE		LE
		

		
Oculus Achievement XO	Company/Brand/Material	Oculus Achievement XO
-7.25 BC 8.0 DIA 9.3	Lens parameter	-6.50 BC 8.1 DIA 9.3
Adequate centration; Interpalpebral	Centration	Adequate centration; Interpalpebral
Adequate 1.0mm movement	MOB	Adequate 1.0mm movement
Slightly pooling	Central Zone	Slightly pooling
H: Alignment V: Slightly pooling	Mid periphery Zone	H: Alignment V: Slightly pooling
Adequate	Periphery Zone	Adequate
Mild lens sensation, can feel the lens sliding down	Comfort	Good comfort
1.0	VA	1.0
-0.75 (1.5-)	O/Rx (VA)	-0.75 (1.2-)
Slightly steep fit	Lens comment	Slightly steep fit

Following the aftercare assessment for the initial pair of contact lenses, a total change of three steps (equivalent to -0.75 D) was indicated. As a change of 0.05 mm in base curve (BC) corresponds approximately to 0.25 D of power, altering all three steps in BC would have resulted in an excessively flat fit, which would not be acceptable clinically.

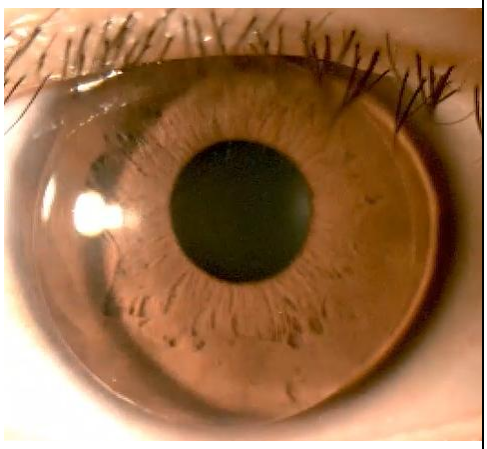
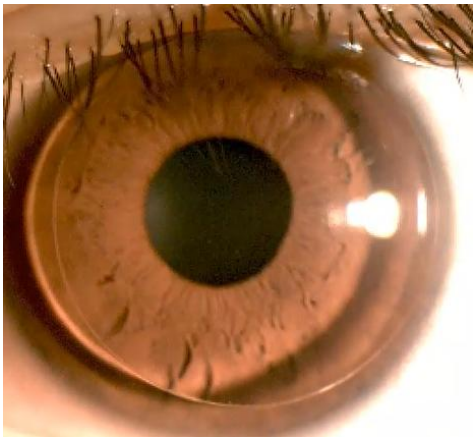
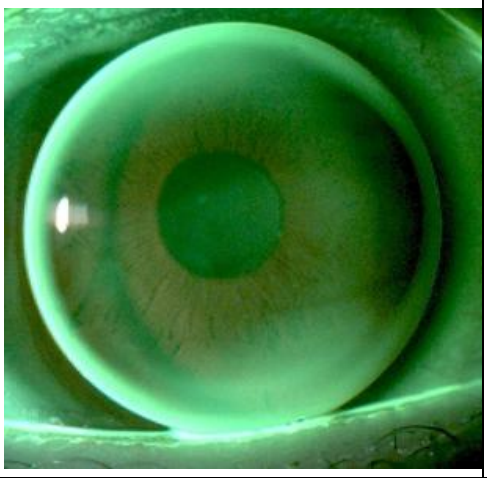
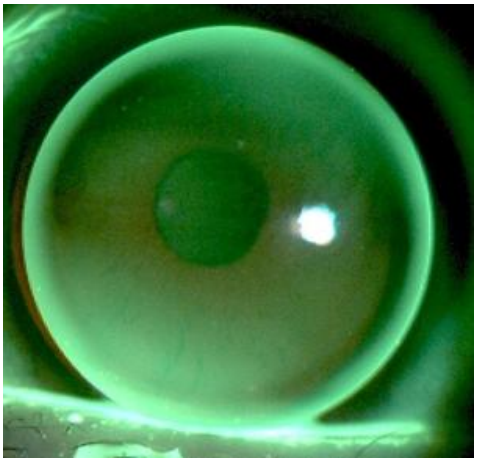
Therefore, the base curve was adjusted by two steps as follows:

Right eye: 8.0 mm → 8.1 mm; Left eye: 8.1 mm → 8.2 mm

To compensate for the partial BC adjustment, the lens power was increased by -0.25 D in both eyes. Based on this finding and the over-refraction results, the lens parameters were refined for reordering.

Lens order					
	Product name	Parameters	Diameter	Material	Color
RE	Oculus Achievement	-7.50 BC 8.1	9.3	XO	GREEN
LE	Oculus Achievement	-6.75 BC 8.2	9.3	XO	VIOLET

2nd Lens delivery

RE		LE
		
		
Oculus Achievement XO	Company/Brand/Material	Oculus Achievement XO
-7.50 BC 8.1 DIA 9.3	Lens parameter	-6.75 BC 8.2 DIA 9.3
Adequate centration; Interpalpebral	Centration	Adequate centration; Interpalpebral
Adequate 1.0mm movement	MOB	Adequate 1.0mm movement
Alignment	Central Zone	Alignment
H: Alignment V: Slightly pooling	Mid periphery Zone	H: Alignment V: Slightly pooling
Adequate	Edge	Adequate
Good comfort	Comfort	Good comfort
1.5	VA	1.2

pl (1.5)	O/Rx (VA)	pl (1.2)
Optimal fit	Lens comment	Optimal fit

An optimal fit was achieved. Lens handling was assessed during this visit. The patient reported satisfaction with the lenses.

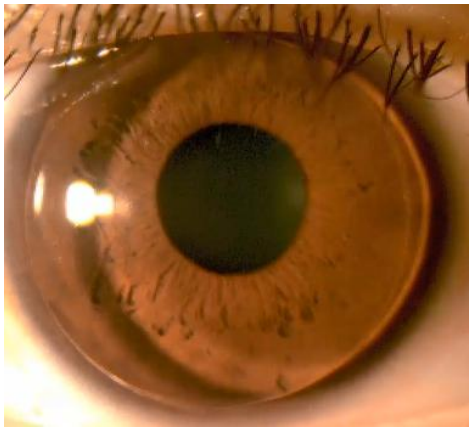
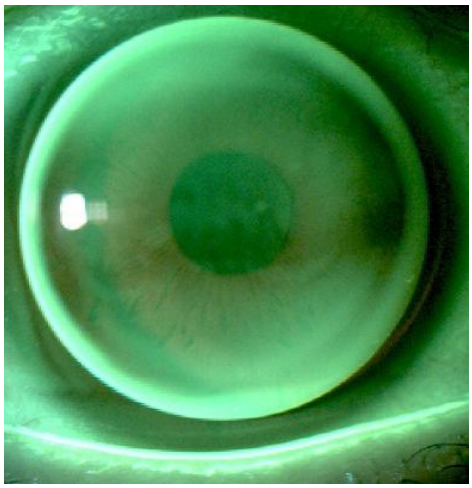
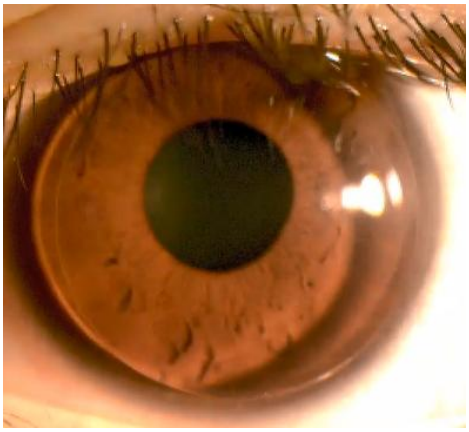
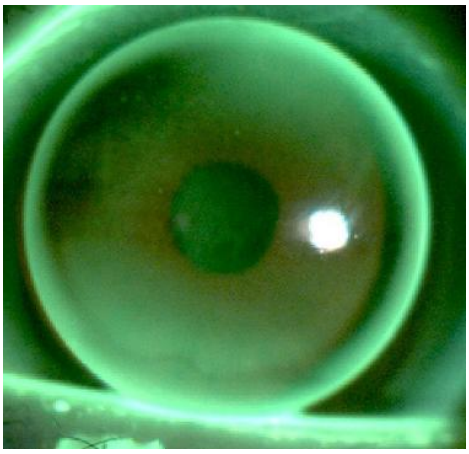
The patient was advised to return for a one-week after-care appointment and to be reminded to wear the lenses for at least four hours before the follow-up visit.

1ST week follow up

Wearing schedule: 10AM -10PM	Time of visit: 3PM	
Time of lens wearing 9 AM		
Insertion: Self	good	
Removal: Self	good	**Chief complaints:** Good vision and good comfort. Well adapted.
Lens caring: Self	good	
Lens care regimen:	Menicare plus + Menicare spray and clean + Saline	

Slit-lamp Biomicroscopy:

Anterior segment: Biomicroscopy	
Lids/Lashes	Clear OU
Cornea	Clear OU
Tear quality	Unremarkable OU, TBUT: 7s OU
Conjunctiva	Clear, no papillae OU
Iris	Flat OU
Lens	Clear OU
Anterior chamber	Deep and quiet

RE		LE
 		 
Oculus Achievement XO	Company/Brand/Material	Oculus Achievement XO
-7.50 BC 8.1 DIA 9.3	Lens parameter	-6.75 BC 8.2 DIA 9.3
Adequate centration; Interpalpebral	Centration	Adequate centration; Interpalpebral
Adequate 1.0mm movement	MOB	Adequate 1.0mm movement
Alignment	Central Zone	Alignment
H: Alignment V: Slightly pooling	Mid periphery Zone	H: Alignment V: Slightly pooling
Adequate	Edge	Adequate
Good comfort	Comfort	Good comfort
1.5	VA	1.5
pl	O/Rx (VA)	pl
Optimal fit	Lens comment	Optimal fit

Optimal fit and good vision were achieved. The lenses were dispensed to the patient. The patient was advised to attend an aftercare in six months.

DISCUSSION

Advantages of RGP

A major advantage of RGP lenses for high myopia is that they produce minimal change in retinal image size. While myopic spectacle lenses cause image minification, RGP lenses preserve the natural image size, providing a larger retinal image and thereby improving visual acuity while reducing the spatial distortion associated with minification.

RGP lenses also address several optical issues commonly encountered with high-prescription spectacles. During near work, myopic patients experience greater accommodative demand with contact lenses compared with spectacles—an important factor when considering contact lenses for older patients. RGP lenses, however, maintain a more natural convergence demand. Spectacle-corrected myopes experience a base-in prismatic effect at near, which lowers convergence requirements, whereas RGP lenses, which move with the eyes, preserve normal convergence demand. For this patient, who is under 40 years of age and has no binocular vision concerns, the changes in accommodation and convergence associated with RGP wear are not clinically significant. Peripheral vision is also markedly improved with RGP lenses. High-powered spectacle lenses can induce peripheral distortions and diplopia, requiring larger eye movements for peripheral viewing. As RGP lenses move synchronously with the eyes, these issues are eliminated, providing a more natural and uninterrupted field of view. In addition, RGP lenses offer a cosmetic advantage by avoiding the minifying effect of high-powered spectacles, which tend to make the wearer's eyes appear smaller.

Managing co-existing dry eye disease is a key consideration in contact lens fitting. Conventional management typically includes lubricating drops, ointments, and, in some cases, temporary or permanent punctal occlusion. Soft contact lenses are generally less suitable, as high-water-content hydrogel lenses are prone to dehydration in a dry ocular environment, leading to discomfort and potential lens ejection. Silicone hydrogel lenses with lower water content are often

more successful in such cases. However, given this patient's prior unsuccessful experience with daily disposable silicone hydrogel lenses, an alternative solution was sought. In this context, RGP, mini-scleral, or full scleral lenses represent appropriate options, as they maintain a post-lens fluid reservoir and minimise tear evaporation from the ocular surface. As the patient is a new wearer of rigid lenses, RGP lenses were initially considered due to their easier handling and smaller size compared with mini-scleral and scleral lenses.

RGP fitting philosophy

For RGP fitting, specific baseline measurements are essential to determine the appropriate trial lens parameters. The horizontal visible iris diameter (HVID) is most efficiently measured using corneal topography. This measurement directly informs the selection of the lens diameter (LD), which should typically be around 1.5 to 2.0 mm smaller than the HVID.

The visible palpebral aperture (VPA) and lid position are also important considerations when selecting lens parameters. A smaller palpebral aperture may require a smaller LD, while the position of the upper eyelid influences the degree of lid attachment. Similarly, if the lower lid sits considerably below the limbus, lens centration may be affected. Assessing lid position is particularly useful when troubleshooting issues with lens centration.

The patient's habitual pupil size and maximum pupil diameter under dim illumination measured 4 mm OU and 5 mm OU, respectively. Although the back optic zone diameter (BOZD) is often pre-determined for a given lens design, it is recommended that the BOZD be at least 1.0 mm larger than the maximum pupil size to minimise symptoms of flare.

Based on the patient's HVID of 11.46 mm OD and 11.6 mm OS, a lens diameter of approximately 9.46–9.6 mm was indicated. For this high myopic prescription, a smaller lens was advised to reduce lens mass and weight, thereby minimising the effect of gravity and helping to

prevent inferior decentration. Given the available trial lens set, a 9.3 mm lens diameter was selected for the initial fitting.

Central corneal curvature was measured using a corneal topographer. The resulting K-readings were used to determine the back optic zone radius (BOZR) of the trial lens and to calculate the degree of corneal astigmatism. A difference of 0.05 mm between K-readings corresponds to approximately 0.25 dioptres of corneal astigmatism.

K-Reading by OCULUS topographer										
RE	Flat K	7.97 (42.3)	@	16.5	Steep K	7.80 (43.3)	@	106.5	HVID	11.46
LE	Flat K	8.12 (41.6)	@	148.8	Steep K	7.90 (42.7)	@	58.8	HVID	11.60

Calculated corneal astigmatism:

RE: (7.97-7.80)/0.05 x 0.25 = 0.85DC

LE: (8.12-7.90)/0.05 x 0.25 = 1.10DC

Corneal topography indicated corneal astigmatism of 0.85 DC in the right eye and 1.10 DC in the left eye, which closely corresponded with the patient's spectacle refraction. As corneal toricity in both eyes was below 2.00 D, a spherical RGP lens was selected, since a back spherical design would sufficiently mask the underlying corneal astigmatism through the tear lens effect.

According to the fitting guide (Rachel Hiscox, 2020), the calculated BOZR values were 7.92 mm OD and 8.02 mm OS. As only 7.90 mm and 8.00 mm lenses were available, 7.90 mm was chosen for OD and 8.00 mm for OS.

Corneal astigmatism	Suggested Initial BOZR
Spherical – 0.75DC	Fit on flattest K-reading
0.75 - 1.00 DC	Between 0 to 0.05 steeper than flattest K
1.0 - 2.50 DC	Between 0.05 to 0.1 steeper than flattest K
Over 2.50 DC	Back surface toric recommended

Based on personal experience with RGP lens management, only about half of patients achieve an optimal fit at the initial trial when using the above guidelines for BOZR selection.

Consequently, these guidelines should be regarded as a useful starting point for the initial fitting but refined according to the observed fitting outcome.

For this patient, although an optimal fit appears to have been achieved on the second trial, the clinician should test a lens that is 0.05 to 0.10 mm flatter to determine whether it produces an acceptably flat fit, thereby confirming the appropriate BOZR to order.

For new RGP wearers, the use of a topical anaesthetic prior to lens application can enhance initial comfort, reduce anxiety during adaptation, improve overall satisfaction, and lower the likelihood of discontinuation. It is also beneficial in reducing the initial reflex tearing response, thereby facilitating a more accurate fitting assessment(Bennett et al., 1998; Gill et al., 2017).

Before lens application, the patient was informed about the expected sensation of lens awareness. It was explained that this feeling is similar to having an eyelash in the eye. The patient was also advised to look downward to minimise eyelid interaction with the lens edge, thereby reducing the sensation of awareness. An initial adaptation period of 20 minutes is considered ideal for assessing lens fit (Wolffsohn et al., 2013). The fitting should not be evaluated until reflex tearing has subsided, as excessive tearing may cause the lens to move excessively and result in rapid clearance of fluorescein.

Corneal warpage after RGP wear

The patient showed an apparently acceptable steep fit on the 1-week follow-up. This highlights the importance of allowing full tear film recovery before finalising the lens parameters, particularly given the patient's dry eye disease and regular use of non-preserved artificial tears for tear film stabilisation. As a properly fitted RGP lens should not distort the cornea, the subtle alteration in the fluorescein pattern is more likely due to tear film improvement resulting from consistent use of Systane Hydration

Corneal warpage is a potential complication associated with RGP lens wear. Poorly fitted RGP lenses can induce slight alterations in corneal shape. These changes occur primarily within the stroma: the main structural layer of the cornea as the epithelium and endothelium provide minimal resistance to mechanical deformation.

All recognised forms of contact lens-induced warpage can be attributed to three underlying pathological mechanisms acting on the stroma: (1) direct mechanical pressure on the cornea from the lens and/or eyelids, (2) contact lens-induced stromal oedema, and (3) mucus adherence beneath rigid lenses. The type and degree of topographic alteration depend on the relative contribution of these factors (Carney, 1975).

Rigid lenses can cause clinically significant warpage, particularly in patients with higher prescriptions requiring thicker lenses or specialised designs. These lenses exert greater mechanical and hypoxic stress on the cornea compared with thinner lenses made from the same material. Adjusting rigid lens parameters can help lessen this impact and minimise corneal shape changes. In cases where rigid lens wear has induced warpage, refitting with soft lenses typically resolves the issue, as soft lenses generally exert little or no effect on corneal topography.

The prognosis for returning to normal corneal topography varies greatly and depends on the cause, extent, and duration of the lens-induced deformation. While recovery from physical forces is unpredictable, recovery from chronic lens-induced oedema is generally observed within seven days after discontinuing lens wear, with oedema-related warpage expected to follow a similar timeline. A contact lens-free period of approximately two weeks is usually sufficient for corneal stabilisation, though the minimum recovery time may differ between individuals (Hashemi et al., 2008). In contrast, soft lens-induced corneal warpage has been reported to resolve within 7 to 21 days (Rayess et al., 2018).

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