The soft approach to RGPs
Part 2: RGP fitting made easy

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Rigid gas permeable (RGP) contact lens fitting is very often thought of as being much more complex and involved compared to soft contact lens fitting. In reality, this is often not the case. RGP fitting today is an easier process and much more successful than the results obtained in the past. Practitioners now have access to lenses that can accommodate a wide range of the ametropic population. In addition, these lenses are easier to fit, initially more comfortable, and require less chair time. The most recent materials offer better wettability, greater stability and centration on the cornea, along with a more predictable and defined outcome.

Developing a cyclic routine as per fitting soft contact lenses is recommended to ensure a full procedure is carried out efficiently. It is good practice to start the consultation with a general discussion with the patient, remembering to ask open, rather than closed, questions, as this generally promotes positive interaction with the patient, making it easier for the practitioner to elicit more valuable information.

This second article in OT’s four-part series continues with a discussion on patient selection, initial examination and general principles of use for successfully fitting RGP spherical lenses.

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Learning objectives
Be able to conduct a relevant history and symptoms, define rigid gas permeable (RGP) baseline measurements; interpret the fitting characteristics of RGP lenses and use these to optimise the subsequent lens fit (Group 5.1.3)

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Be able to conduct a relevant history and symptoms, define rigid gas permeable (RGP) baseline measurements; interpret the fitting characteristics of RGP lenses and use these to optimise the subsequent lens fit (Group 5.1.2)

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About the author
Mark Tomlinson has been in optics for 34 years as a dispensing optician, contact lens optician and optometrist. He currently works as a part-time optometrist and is a practice academy consultant for Alcon, where he lectures on various CET topics including contact lenses. He has previously lectured widely to optometric audiences, including pre-registration students and peers on a local level.
Patient selection and discussion

Optical indications
The patient’s refractive error may well influence the choice of lens which is ultimately fitted. RGP lenses provide excellent visual qualities, particularly for regular or irregular corneal astigmatism, along with patients who possess high amounts of refractive error.2

General health
A detailed knowledge of the patient’s general health is accepted as best practice in optometric care. Moreover, there are specific areas particularly relevant to contact lenses which may need clarifying.

The patient should be asked about allergies as the allergic patient is more susceptible to adverse reactions to contact lenses and their maintenance products.3 Current medication use should be clarified as the use of some systemic and topical medications can alter the tear film and make contact lens use more challenging. Practitioners should also be aware that diabetes may cause corneal hypoesthesia (reduced sensitivity), leading to an increased risk of corneal abrasions and infection.

Pregnancy and the menopause may cause an increased risk of corneal oedema and mucus accumulation, due to the significant changes caused to the tear film by hormonal changes.4

In general, contact lens fitting should be avoided during pregnancy, particularly if the patient is affected by water retention. Asking, “Is there anything else about your health that you think I should know?” is often a good way to complete the health check.

Complexion
Observe the patient’s complexion during the initial dialogue. Auburn hair and freckled skin can indicate an increased corneal sensitivity,4 which may hinder adapting to RGP lenses.

Contact lens history
A complete history of any previous contact lens experience (albeit positive or negative) is essential to provide the clinician with the relevant information to discuss the lens choices available.

Ocular health
Ask the patient about any ocular history, such as a previous ocular injury, lid infections, blepharitis, conjunctivitis, dry eye, cataracts, glaucoma and any other surgery to the eye or adnexa.

Motivation and expectations
Establish patient motivation and their expectations. Patients with poor motivation may not possess the required determination to succeed with RGP lenses and may be non-compliant in the care of their lenses.

Determine the patient’s aspiration on wearing times, bearing in mind that part-time or ‘social’ wearers do not make ideal RGP patients. Consider the patient’s sporting and physical activity requirements when using their lenses, along with specific occupational requirements.

Financial considerations
Practitioners should avoid choosing products for their patients based purely on financial considerations. Explanation at the initial consultation should be given to the anticipated costs involved for the lenses and their maintenance. It would also be prudent to inform the patient what consultations are likely to be required in order to satisfactorily complete the contact lens fitting.

Patient examination and initial measurements

Horizontal visible iris diameter (HVID)
HVID should ideally be taken using a slit lamp with an eyepiece graticule, or adjustable slit height; however, in reality a ruler, or adapted rule is commonly used (Figure 1). This measurement provides an initial indication as to what the overall (total) diameter of the RGP lens will be. Most textbooks suggest that the lens total diameter should be approximately 1.5-2.0mm less than the HVID.4,5

Visible palpebral aperture (VPA)
VPA may also influence the diameter of the contact lens, however, the actual value of the VPA is questionable.6 Greater relevance would generally be given to the position of the lids with respect to the limbus.6 The position of the upper lid can influence the degree of lid attachment, while the lower lid, if significantly low, may encourage the lens to centre, inferiorly.

Pupil diameter/size
Pupil size is measured in both normal ambient light and in reduced illumination using a Burton lamp. This measurement should be used as a guide to ensure the Back Optic Zone Diameter (BOZD) is greater than the largest pupil diameter. Generally, this approach will minimise symptoms associated with flare.

Examination of the anterior segment
Using the slit lamp, set with a broad beam and low magnification, the practitioner should carry out a ‘Z-like’ sweep of the anterior segment and adnexa. Start by examining the lids and lid margins, looking for signs of cysts, styes, meibomian gland dysfunction and other localised inflammation, including blepharitis.

Assessment of the bulbar and palpebral conjunctiva should then be made, checking for hyperaemia, pingueculum, pterygium, follicles and papillae. It may be advantageous to make use of published grading scales (see Figure 2).7

The cornea is examined next, initially with a medium magnification (x16 to x20), again using a ‘Z-like’ sweep to assess the entire cornea, using a beam width of approximately 2mm, initially. An angle of 45 to 60 degrees between the microscope and beam will give the user a reasonable appreciation of depth. Should any anomaly be detected, the magnification can be increased and the beam width also adjusted, accordingly. Grading and recording any abnormalities is fundamental for accurate record keeping, particularly for comparative checks which may be carried out in the future.

The cornea should also be assessed after fluorescein installation, prior to any contact lens fitting. Fluorescein stain in conjunction

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Tear film assessment quantity and quality
Assessment of the tear film should be part of any routine contact lens examination. Tear quantity can be estimated by observing the tear prism in section. A normal tear prism should appear convex in section and measure about 0.2-0.4mm in height at the centre and 0.1-0.2mm at the periphery. Frothing of the tears in the prism section indicates lipid contamination, most likely due to meibomian gland dysfunction. Tear quality can be assessed by noting the tear breakup time (TBUT) after instilling a drop of fluorescein. Observe the tear film with the slit lamp using the cobalt blue filter, instruct the patient to blink, and note the time for spots or streaks to appear in the tear layer. Typically this should be in excess of 15 seconds, anything under 10 seconds would be considered abnormal.

Non-invasive tear breakup time (NIBUT), typically measures the stability of the tears using a keratometer, but without adding any staining agent. Here, the patient is asked to blink once, and then the time taken for the reflected mire image to distort is recorded. A typical time using this method is approximately 15-20 seconds.

Specular reflection
Specular reflection is a slit lamp technique, which may be used for assessing debris in the tear film, by studying the first Purkinje image of the lamp to show possible colour fringes. These moving swirls of colour can indicate an estimate of tear film thickness. They can also reveal lipid layer movement and disturbances.

Corneal curvature
Keratometers are used in practice to provide ‘K’ readings, measuring the curvature of the central cornea over a diameter of approximately 3-6mm to determine the radii of curvature and the directions of the principal meridians. In this way, this valuable measurement provides the practitioner with an indication of the back optic zone radius (BOZR) of the lens. Keratometry will also reveal the amount of corneal astigmatism and any corneal distortion present.

Corneal astigmatism
The keratometer readings, together with the refraction, will guide the practitioner to the nature of the astigmatism. An assumption that can be made here is that:

Total ocular astigmatism = corneal astigmatism + lenticular astigmatism.

Broadly speaking, there are four sub-categories when comparing ocular refraction to the ‘K’ readings, namely:

• Spherical cornea with a spherical refraction
• Spherical cornea with an astigmatic refraction
• Toric cornea with an astigmatic refraction
• Toric cornea with a spherical refraction.

Spherical RGP lenses will only correct corneal astigmatism, and will have no effect on the correction of lenticular astigmatism.

Examples of typical scenarios and associated outcomes are as follows (as a rule of thumb, 0.10mm difference between K readings equates to 0.50 DC of corneal astigmatism):

**Example 1**
- **Rx**: -2.00 / -1.75 x 180
- **K readings**: 7.80mm along 180
  - 7.50mm along 90

Here, the corneal astigmatism corresponds to the ocular refraction, therefore, spherical RGP lenses would provide a suitable option.

**Example 2**
- **Rx**: -3.50 DS
- **K readings**: 7.95mm along 180
  - 7.65mm along 90

In this example there is an equal amount of ‘with the rule (corneal)’ and ‘against the rule (lenticular)’ astigmatism, of approximately 1.50 DC. In this instance, fitting a spherical RGP lens would neutralise the corneal astigmatism, leaving the lenticular (residual) astigmatism of -1.50 x 90DC uncorrected.

Principles of RGP lens fitting
Generally speaking, practitioners using ‘in house or system lenses’ only have to deliberate about the total diameter (TD), back optic zone radius (BOZR) and back vertex power (BVP). Although other dimensions are significant (see Figure 3), the manufacturer will make most of the design decisions.

One of the major benefits of fitting RGP contact lenses is the superior level of vision that patients will derive from them. This immediate superiority will often be undermined if practitioners fit using diagnostic lenses, where the BVP of the lens is unlikely to match the patient’s prescription. Fitting RGP lenses empirically allows the patient to experience first-hand this enhanced visual quality. Fitting lenses that are as close as possible to the patient’s prescription will also minimise changes in fit from variation in power. If using diagnostic lenses, it is important that myopes are fitted with a minus correction, and vice versa.
Assessing the lens fit

Similar to fitting soft contact lenses, the assessment of RGP lenses involves evaluating both the static (how the back surface of the lens aligns to the cornea) and dynamic (how the lens centres and moves on the eye) fitting criteria. Once initial reflex tearing has subsided (usually within five to 15 minutes after insertion), assessment of the fit can be made. Instilling fluorescein aids the assessment of the static fit of a RGP lens. Sodium fluorescein is orange in colour, and when diluted in an aqueous solution is excited by short wavelength light (blue), to emit a green coloured light at a maximum intensity of 525-530nm. Although the Burton lamp may be used to assess the fitting of a RGP lens, the slit lamp, using both white and cobalt blue light, will provide the practitioner with a more thorough means of assessment. The contrast of the fluorescein pattern can be improved further with the use of a yellow barrier filter.

Good, aligned fit characteristics
- Good lens centration. The lens should be centred over the pupil in primary gaze, and centration remains adequate with each blink. This will help to ensure that the visual axis remains within the BOZD of the lens and minimise flare
- The lens should remain on the cornea during all positions of gaze
- Visual acuity should be crisp and stable
- Alignment type fluorescein pattern shows alignment or slight apical clearance over the central region, mid peripheral touch and a narrow band of edge clearance of approximately 0.50mm in width (see Figure 4)
- With a normal lid position, the edge of the lens should not overlap the limbus. The ideal position of the lens is when the edge of the lens is near the superior border of the limbus and is covered by the upper lid during blinking
- 1-1.5mm of vertical smooth movement with each blink. This is one of the main characteristics of a well-fitted RGP lens. This movement facilitates tear exchange, allowing metabolic and tear debris to be removed from under the lens, along with oxygen exchange during the blink cycle due to the tear pump action
- When the lids are held apart the lens should slowly decentre downwards
- Reasonable initial comfort, which continually improves during adaptation.

Flat fit characteristics
- A central darker area of apical touch (due to the absence of fluorescein)
- Very broad green edge band of lens clearance (see Figure 5)
- Excessive movement on blinking (be aware of excessive initial tear lacrimation which may be misinterpreted)
- Possible conjunctival staining
- Patients often find that comfort is poor and adaption is severely compromised
- Excessive tearing even after adaptation period
- Inconsistent vision
- A negative tear lens is formed, leading to a ‘plus powered’ over refraction.

Steep fit characteristics
- Appearance of excessive central green ‘pooling’ beneath the lens, which may also include trapped air bubbles under the lens. A darker excessive touch in the mid peripheral region (see Figure 6)
- Minimal lens edge clearance
- Movement is static and sluggish. Insufficient lens movement will hinder an adequate tear exchange; this stagnation of the tears leads to corneal staining and distortion
- Possible corneal epithelial indentation caused by the edge of the lens
- Minimal lid sensation reported by the patient
- A positive tear lens will be formed beneath

Table 1

<table>
<thead>
<tr>
<th>Amount of corneal astigmatism</th>
<th>Suggested first fit BOZR with spherical RGP lens</th>
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<tbody>
<tr>
<td>0.0 – 0.75 DC</td>
<td>Fit on flattest K reading</td>
</tr>
<tr>
<td>0.75 – 1.00 DC</td>
<td>Between 0.00 – 0.05 steeper than flattest K</td>
</tr>
<tr>
<td>1.00 – 2.50 DC</td>
<td>Fit close to flattest K between 0.05- 0.10 steeper</td>
</tr>
<tr>
<td>Over 2.50 DC</td>
<td>Back surface toric (discussed in a later article)</td>
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If at first you don’t succeed…
Most modern RGP system lenses are designed to facilitate ease of fit; this will generally offer practitioners the reassurance that, providing they follow the essential guidelines, most lenses fitted will invariably provide an optimal result. However, situations might occur when the first fit lens does not generate the result we were expecting. What management options are there?

Decentration
Excessive decentration in any direction is indicative of a flat fitting lens, where a steeper fit would be appropriate. Excessive corneal astigmatism may also be a factor, where fitting a back surface toric would remedy this. A completely stationary lens is fitting too steep, and a flatter design would be required.

Where horizontal decentration occurs, if caused by the eyelids, then a smaller diameter lens should be used. If the lids are not the cause, then either fit a lens with a larger diameter, or steepen the BOZR. Against the rule astigmatism may also be responsible; here spherical lenses will not work and a back surface toric should be considered.

With continually low decentration, the lens may be too thick, particularly in higher prescriptions. Also, consider that the overall diameter of the lens is too small, especially relevant if there appears to be no lid interaction.

If you observe continually high decentration, again the thickness of the lens may have to be evaluated and, if necessary, reduce the lens thickness. The diameter of the lens may be too big, or excessive amounts of against-the-rule astigmatism may be to blame. This could only be properly remedied with a back surface toric RGP.

Increase movement
To increase movement of a RGP lens:
- Increase BOZR
- Decrease BOZD
- Decrease total diameter.

Decrease movement
To decrease movement of a RGP lens:
- Decrease BOZR
- Increase BOZD
- Increase total diameter.

Basic rules of thumb for alterations to maintain fitting relationship
BOZD and BOZR:
- An increase in BOZD of 0.5mm will require a flattening of the BOZR by 0.05mm
- A decrease in BOZD of 0.5mm will require a steepening of the BOZR by 0.05mm.

BOZR and BVP:
- An increase in BOZR of 0.05mm will require 0.25D less minus prescription
- A decrease in BOZR of 0.05mm will require 0.25D more minus prescription.

Other points
Increasing the diameter will generally aid comfort, while decreasing the diameter will have the opposite effect.

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References Visit www.optometry.co.uk/clinical, click on the article title and then on ‘references’ to download.
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