NORMAL DESIGN GP FITTING GUIDE

E & E Optics with their sophisticated lens design and manufacture provides a wealth of parameters, power range and lens designs. Using custom-made multi-curve lens designs increases the practitioner flexibility in dealing with a range of corneal contours - many spherical and aspheric 'system' lens designs can cover most outcomes. The principles to fitting GP contact lens is actually very straightforward as in selecting an initial lens and assessing a fit. The fitting guidelines as below – concentrate on basic procedures and techniques.

Lens design

The normal design GP contact lenses are spherical lenses with multi-curve designs where each radius of curvature progressively increases to mimic corneal flattening. Figure 1 shows the dimension of a spherical design GP lens. The radius of curvature of the back surface of the lens is known as the back optic zone radius (BOZR) and the size of this optic is termed the back optic zone diameter (BOZD). The total diameter (TD) describes the overall size of the lens.

For an ideal fit, the back surface of the RGP will align with the anterior corneal surface to ensures the pressure exerted on the cornea is evenly distributed across the whole area under the lens. And at the same time limiting the mechanical effect of the lens on the corneal surface, and minimises lens flexure, thus promoting lens comfort. In an ideal or alignment fit, a thin layer of tear film forms between the cornea and back surface of the lens. The periphery of the lens is specially designed to allow for edge clearance to facilitate tear exchange and lens removal. An ideal fitted lens should allow for effective tear exchange to maintain normal corneal physiology. Steep fitted lens causes pooling of the tear lens which can cause stagnation. And flat fitted lens can cause mechanical complications due to corneal touch.

Initial measurements

The standard investigations must be undertaken prior to contact lens fitting. A number of additional initial measurements are necessary to select the different parameters of the trial lens.

Horizontal Visible Iris Diameter (HVID)

HVID is measured using an adapted ruler as in figure 2 and this information will bring about the total diameter (TD) for selecting the suitable trial lens, which should be approximately 1.5 to 2mm smaller than the HVID.

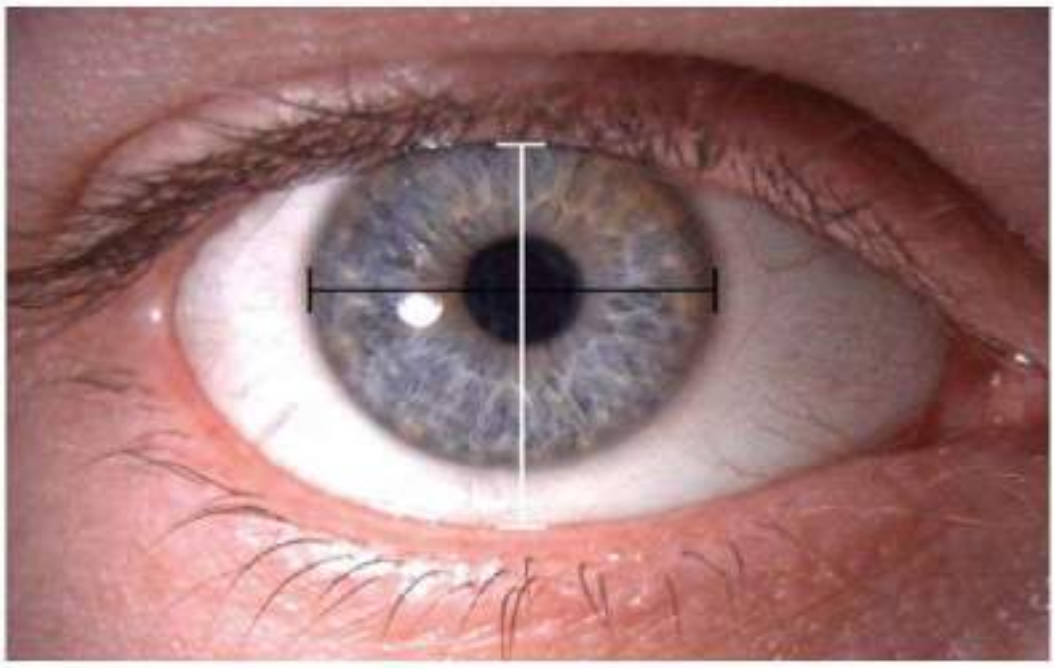

Figure 2: (1) Horizontal Visible Iris Diameter (HVID) – Black Line (2) Visible Palpebral Aperture (VPA) – White Line

Visible palpebral aperture (VPA) and lid position

The VPA and lid position in relation to the limbus can be used to inform the TD, as a smaller palpebral aperture may benefit from a smaller TD. The upper eyelid position can affect the extent of lid attachment while centration may be affected if the lower lid lies significantly below the limbus. Consideration of the lid position can be particularly useful when troubleshooting a poorly centered lens.

Pupil diameter

Habitual and maximum pupil size, measured in a darkened room with the eye illuminated using the UV light on the Burton lamp, should be recorded. While the BOZD is typically pre-determined for a particular lens, it should ideally be at least 1.0mm larger than the maximum pupil size to avoid symptoms of flare.

Assessment of central corneal curvature

Central corneal curvature can be recorded with either a keratometer or corneal topographer. Central keratometry readings (K-readings) are used to determine the BOZR. Spherical lenses can correct moderate corneal astigmatism through neutralisation by the tear lens. If astigmatism is lenticular, a spherical RGP lens will have no effect on its correction.

Initial lens selection

Lenses can be fitted either empirically, where the baseline data is supplied to the manufacturer, or with a diagnostic lens from a fitting set. When fitting normal design GP lenses, practitioners typically only need to specify the BOZR, TD, back vertex power (BVP), lens material and lens color. If one prefer the use of diagnostic lenses as it can reduce chair time, as diagnostic sets typically only come in a single power. This can result in changes to the fit due to variation of power; the lens thickness, centre of gravity and even edge profile can vary between different lens powers. Therefore, myopes should be fitted with minus powered diagnostic lenses and hypermetropes with plus powered diagnostic lenses. While fitting lenses empirically has the advantage that patients get to appreciate the visual correction/quality it can lengthen the fitting process if the lens parameters need to be altered.

Lens application and initial adaptation

Prior to lens application, patients should be instructed on the lens awareness sensation they are likely to experience. This experience can be likened to having an eyelash in the eye. Patients should be encouraged to look downwards to minimise the interaction of the lid on the lens edge and reduce the sensation of lens awareness. Assessment of the lens fit should not take place before reflex tearing has subsided as the lens will move excessively and fluorescein will be washed away too quickly.

Where possible, new lenses should be hydrated in a soaking solution for at least 24 hours prior to lens application. After initial adaptation, the patient should be tolerably aware of the lenses and any reflex lacrimation should have stopped. If the patient reports discomfort or a foreign body sensation, lifting the upper eyelid will enable the practitioner to judge whether or not any discomfort is due to normal adaptation (in which case it will disappear when the lid is lifted) or a foreign body trapped between the lids (in which case it will remain).

Lens fit assessment

The assessment of RGP lens fit involves the evaluation of both static and dynamic criteria. The dynamic fit should be assessed with the slit lamp using white light (ideally with a diffuser), low magnification and with sufficient illumination to aid observation but not too bright as to initiate lacrimation. Examination should include assessment of the following:

Dynamic assessment with low-medium magnification and diffuse white illumination

- **Centration**

Lens centration should be assessed in the primary position, with the relationship to and the interaction with the lids considered. Lenses may fit between the VPA, known as interpalpebral or show lid attachment, where the upper lid controls centration. Centration can be recorded.

- **Movement on blink**

Lens movement on blink can be estimated by comparing the movement to a known slit beam height or to the lens TD. It can also be beneficial to record the speed and direction of movement immediately following a blink.

- **Coverage**

Lens coverage should be assessed by instructing the patient to look in the four positions of gaze, with any lens crossing of the limbus recorded. Care should be taken to ensure appropriate initial adaptation has been allowed as reflex tearing can cause excessive lens movement and an inaccurate interpretation of
lens fit.

Static fluorescein fit assessment with low-medium magnification and cobalt blue illumination

Assessment of the static fit allows the practitioner to interpret how the back surface of the lens aligns with the cornea; fluorescein dye – **Fluostrips** is used to aid visualisation of the tear lens. The fluorescein pattern should be observed using a slit lamp with a cobalt blue filter in combination with a Wratten filter to enhance the contrast.

The fluorescein pattern is best evaluated when the lens is centred, which may require manipulation of the eyelids. Failure to re-centre the lens can lead to misinterpretation of the fluorescein pattern. The level of fluorescence is a function of the thickness of the tear lens. Therefore, areas of touch or minimal clearance will appear dark whereas areas of excessive clearance, showing pooling of the tear lens, will appear very bright. By assessing the change in intensity of the fluorescein across the lens, the distance between the posterior lens surface and the cornea can therefore be interpreted. The eye care practitioner should systematically assess the fluorescein pattern in three regions: centre, mid-periphery and periphery.

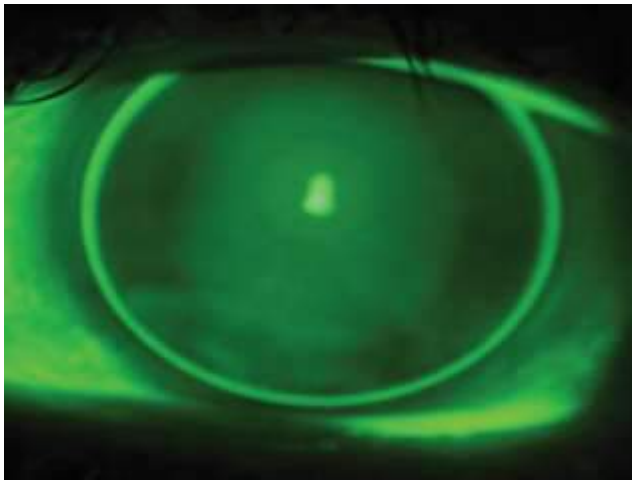

Figure: Fluorescein patterns for fitting lenses

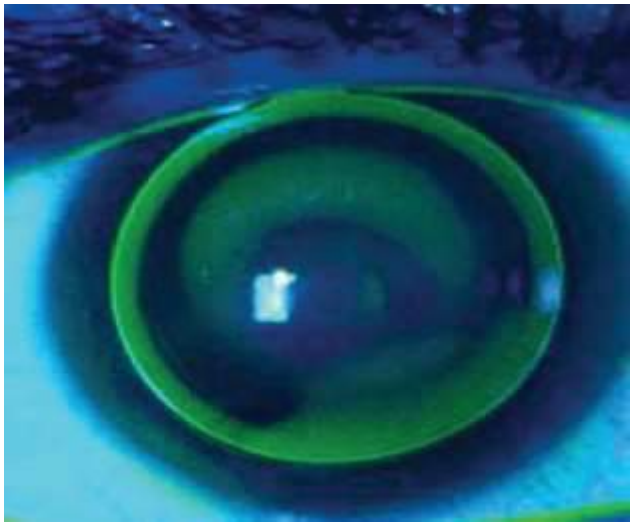

Figure: Fluorescein patterns for steep lenses

Vision assessment and over-refraction

A spherical over-refraction is essential to determine if a change in the final lens power is necessary. For an alignment fit the visual acuity should be crisp and stable with a precise end-point of refraction.

However, if the lens is not fitting on alignment, the tear lens will induce unwanted power. If the lens is fitting steep, a positive tear lens will result and a negative over-refraction will be required. If the lens is fitting flat, a negative tear lens will result and a positive over-refraction will be required.

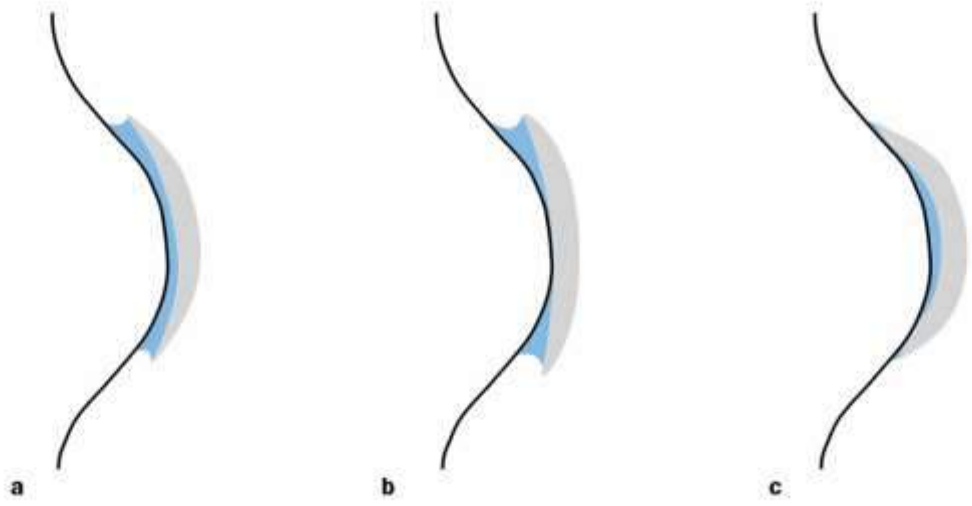

Figure 6: Tear lens profiles for an aligned fit (a) that does not induce unwanted power, a flat fit (b) that forms a negative tear lens and a steep fit (c) that forms a positive tear lens

Interdependency of fitting variables

Please take note that every variable in RGP lens design has an inter-dependency on other variables.

Troubleshooting

Modern GP lenses are designed to fit the majority of patients. Undesirable patient symptoms or fitting characteristics can often be managed by modifying certain lens parameters, which are summarized below. Discomfort that persists past the initial adaptation period is typically associated with poor lens fit, excessive corneal astigmatism or even a trapped foreign body. While unstable vision is likely to be caused by a flat fitting lens, poor vision may be the result of incorrect lens power, residual astigmatism or even lens flexure. Decentration in any direction is typically an indication the lens is too flat. However, it may also be caused by corneal astigmatism; with-the-rule astigmatism typically causes vertical decentration whereas against-the-rule can cause lateral decentration. It is worth noting that E & E Optics do provide invaluable technical support and can provide comprehensive advice when troubleshooting.

Causes and management of common undesirable patient symptoms or fitting characteristics

Complaint: Poor Comfort

Possible Causes	Management
Excess movement	Tighten fit
Excess edge clearance	Reduce edge clearance
Edge too thick	Thinner edge
Foreign body	Remove and replace lens
Damaged lens edge	Replace lens
Astigmatic cornea	Refit with toric lens
Patient sensitivity	Increase TD
Poor wetting	Change material

Complaint: Poor Vision

Possible Causes	Management
Refractive change	Refract and change power
Corneal shape change	Assess fit and modify
Residual astigmatism	Refit with toric lens
Flexure	Refit with aspheric or toric lens
Deposits	Clean lens or change material
Heavy surface scratches	Replace lens
Poor wetting	Remove and clear lens, replace if old, change material

Complaint: Lens centering high, not dropping after blink

Possible Causes	Management
Excessive TD	Reduce TD
Lens too thick	Reduce thickness
With the rule astigmatism	Modify fit, consider aspheric or toric design

Complaint: Lens decentering inferiorly

Possible Causes	Management
Lens too flat	Steepen fit
Inadequate TD	Increase TD
Lens too thick	Reduce thickness

Complaint: Lens decentering laterally

Possible Causes	Management
Lens too flat	Steepen fit
Inadequate TD	Increase TD
Against the rule astigmatism	Modify fit, consider aspheric or toric design

Complaint: Lens is stationary

Possible Causes	Management
Lens too steep	Flatten fit