

**“PULL
OUT
SECTION”**

Contact Lenses

IRREGULAR CORNEAS

TAKING THE SOFT OPTION

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Do you see any patients with keratoconus, pellucid marginal degeneration (PMD), post graft or post laser corrective surgery who want to see better and more comfortably than they can at present? If so, what can you offer them?

The KeraSoft® range of contact lenses now offers a lens for each condition. First of all let's understand more about the types of corneas that you might see, and the details that need to be considered when deciding which lens to fit.

For the purposes of KeraSoft fitting, irregular corneas fall into two main categories – ectasia and non-ectasia – as illustrated in **Figure 1**. Kerectasia

is a bulging of the cornea and can be due to keratoconus, PMD or, in some cases, it can occur after laser corrective surgery. Non-ectasia conditions include some post laser surgery cases, trauma and post corneal graft.

When fitting an irregular cornea, it is important to establish which of these conditions the patient has – as each has different characteristics. Topography images are a very useful tool in the investigation.

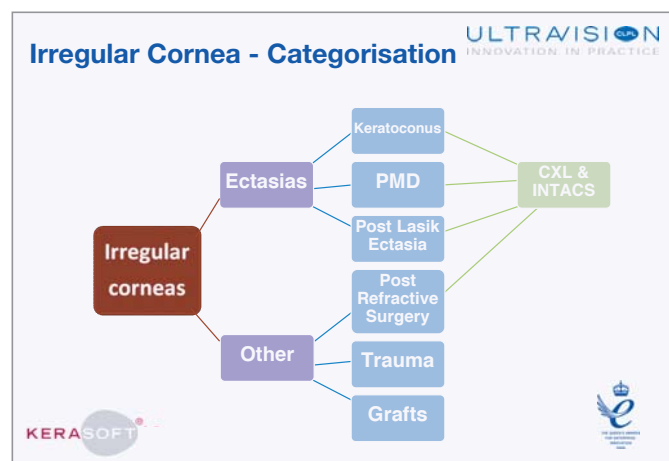


Figure 1. Categorisation of the irregular cornea

Keratoconus vs. PMD

First we will look at the difference between keratoconus and pellucid marginal degeneration (PMD) – as these are often difficult to differentiate. Keratoconus is characterised by a steepening of the cornea that tends to be more centrally positioned. In PMD, the steep area is more peripheral and may even extend to the limbus. It is characterised by a central flat area with a ‘kissing birds’ or ‘crab’s claw’ appearance – as can be seen from the topographies in **Figure 2**.

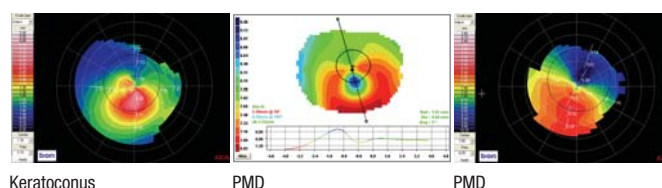


Figure 2. Different characteristics of keratoconus vs. PMD

Keratoconus usually presents with medium to high myopia, whereas PMD refractions typically exhibit a low sphere with high minus cyls in the vertical axis. The second PMD example in **Figure 2** could be mistaken for a typical inferior keratoconus with central K of around 6.15, however, by studying the patterns it can be seen to present more of a PMD appearance with a flat superior corneal curvature of 8.20mm. PMD cases can give relatively steep central Ks using a normal keratometer, which can be misleading and may sometimes lead to a misdiagnosis.

Post laser corneal surgery

Patients who have undergone laser refractive corrective surgery are usually very happy with their sight. In some cases, where the cornea becomes irregular and the vision is reduced, the practitioner needs to diagnose if there is ectasia or not. If there is ectasia, there will be a steepened cone within a much flatter central area and the peripheral region will often be characteristically steep.

Post graft

Post graft patients will typically have a central flatter cornea with steepening in the periphery.

Table 1 shows a summary of the types of irregular cornea.

General irregular cornea differential diagnosis summary				
	Ectasia			Non-ectasia
	Keratoconus	PMD	Post laser refractive surgery	Post grafts, post refractive surgery & trauma
Cone position	Usually inferior and reasonably central	Low cone often near the limbus	Usually central/inferior	No cone
Refraction	Typically medium to high myopia	Typically low minus to plus with high minus cyls	Typically medium minus with medium minus cyls	Typically low minus to plus with low minus cyls but can present with high cyls
Topography image	Steep central cornea	Flat central cornea with 'kissing birds' appearance	Steep central cornea	Flat central cornea with steep periphery

Table 1. Summary of the differential diagnosis of the irregular cornea

Available options

For the conditions shown in **Table 1**, the following options are available:

- RGP contact lenses
- Piggyback lenses
- Hybrid lenses
- Scleral contact lenses
- Semi scleral lenses
- Cross linking (CXL)
- Corneal transplant
- KeraSoft contact lenses

This article discusses the KeraSoft option only.

Why take the soft option?

KeraSoft lenses now have the following benefits:

- KeraSoft lenses have been shown to significantly delay the need for grafting in advanced cases of keratoconus and PMD.
- Research now shows that flat-fitting RGPs are a significant cause of apical scarring in keratoconic patients, leading to corneal transplants. Since a good fitting RGP can become a flat fitting one quite quickly due

to progression, fitting KeraSoft from the point of diagnosis ensures that this type of scarring does not occur.

- Silicone hydrogel offers a much healthier option, with increased oxygen supply to the corneal surface and is much more gentle on the eye. Most patients report a significant reduction in photophobia and irritation, compared to RGP wear, leading to a welcome reduction in eye rubbing.
- Longer wearing times are possible with KeraSoft lenses, which for extreme keratoconic and PMD sufferers can make the difference between blindness/partial sight and being able to carry out a normal life.
- The extensive range of prescriptions covering sphere ± 45.00 DS, cyls to -18.00 DC and fully configurable base curve, peripheral curves and overall diameters makes these lenses a suitable option for all cases, regardless of prescription and parameters.
- In cases of unilateral irregular corneas, KeraSoft provides a comfortable option. Many wearers will not tolerate unilateral RGPs but they will tolerate unilateral KeraSoft lenses.

The KeraSoft range of contact lenses has been developed over many years in UltraVision's Cambridge based R&D centre. The range has been in wide use in hospitals and practices around the world for more than 12 years. During that time, new innovations have been developed, including the use of silicone hydrogel material and award winning wavefront optics designs. These benefits, along with advanced stabilisation and fitting methods, led to the launch of KeraSoft®3 in December 2007. Recently UltraVision launched the KeraSoft® IC, a silicone hydrogel lens, designed to cover all aspects of irregular cornea fitting.

Figure 3 shows a guide to which first choice KeraSoft lenses to use for each condition.

Condition	KERASOFT ³	KERASOFT ^{IC}
Keratoconus	✓	●
PMD	▲	✓
Post laser surgery with ectasia	✓	✓
Post laser surgery No ectasia		✓
Trauma		✓
Post graft	▲	✓

● = SMC can be used in some cases
 ▲ = KeraSoft3 can be used in mild to moderate cases

Figure 3. A guide to the first choice KeraSoft lenses for different conditions

KeraSoft3

KeraSoft3 is the first lens of choice when fitting keratoconus. The practitioner uses the eight-lens trial set to obtain the best fit, using standard soft lens fitting techniques. The KeraSoft3 lens is then ordered, giving details of the fitting lens used, the over-refraction, orientation of the lens and any other fitting parameters such as preferred overall diameter.

KeraSoft IC

KeraSoft IC is available in two forms:

- Steep/standard/flat periphery
- Sector Management Control (SMC)

Kerasoft IC Steep/standard/flat periphery

The steep/standard/flat periphery form is used when fitting corneas that have mild ectasia and flat peripheries, or that require a steep periphery and a flatter central area, e.g. post graft cases. KeraSoft IC fitting lenses are

available to evaluate the fit and to establish the power required, and are combined with information from topography to arrive at the best fit for the irregular cornea. The final powered lens can then be ordered.

Kerasoft IC SMC

KeraSoft IC is the first silicone hydrogel lens to offer Sector Management Control (SMC). SMC allows individual customisation of the lens periphery to enhance fit, vision and comfort – a concept known in RGP design but until now, not achieved with a silicone hydrogel material. It is especially suitable for corneas where there are large differences between the flattest and the steepest areas. Although PMD is an obvious choice for this design of lens, classical keratoconus can also present with a large contrast between steep and flat areas and the SMC design can improve stability and acuity on such corneas.

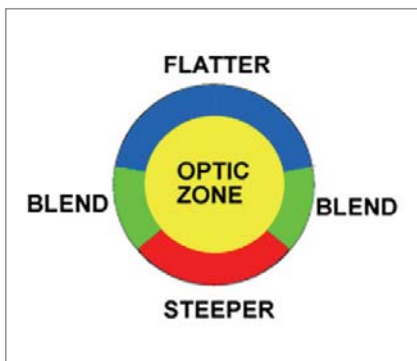


Figure 4. Standard central optical zone of the KeraSoft IC SMC

The KeraSoft IC SMC has a standard central optic zone (Figure 4). The periphery can be individually customised to allow steeper and flatter sectors with a continuous blend between the two sectors. Thereby the SMC enables the periphery to be designed so it more closely matches the curvatures of the irregular cornea (Figure 5).



Figure 5. Matching periphery design to the curvature of the irregular cornea

KeraSoft IC SMC: defining the sector areas

The practitioner can use topography images to define the sectors of the lens. This is illustrated using the example shown in Figures 6 and 7.

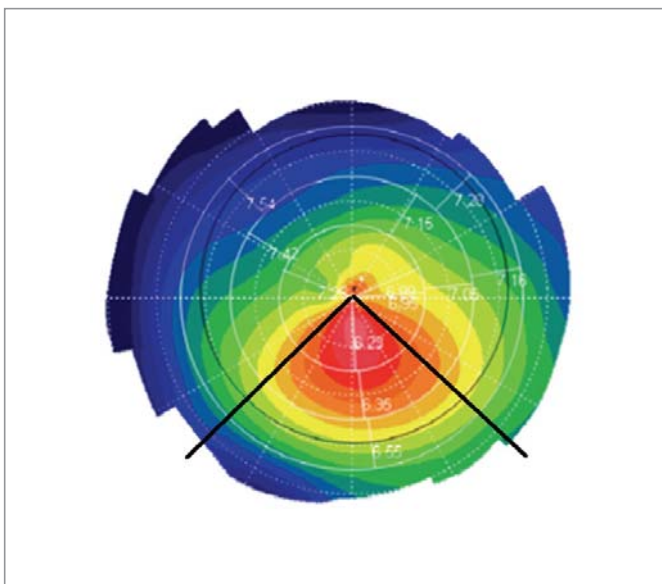


Figure 6. Topography image

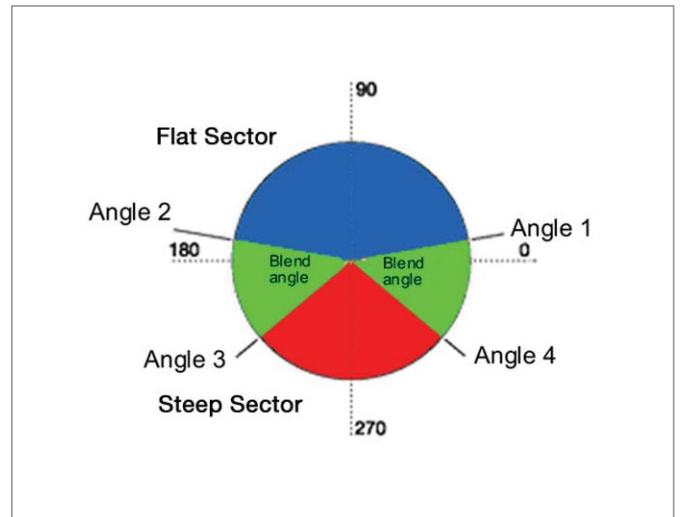


Figure 7. Schematic of the flat and steep sectors

Optometric convention is followed in order to identify angles 1, 2, 3 and 4, which are noted in an anti-clockwise direction, as in refraction (Figure 7). Thus, angle 1° is the beginning of the flatter sector and angle 2 the end. Angle 3 marks the start of the steep sector and angle 4 the end. The areas in between are recorded as the blend angles. Although this example is symmetrical, any angles can be defined and manufactured.

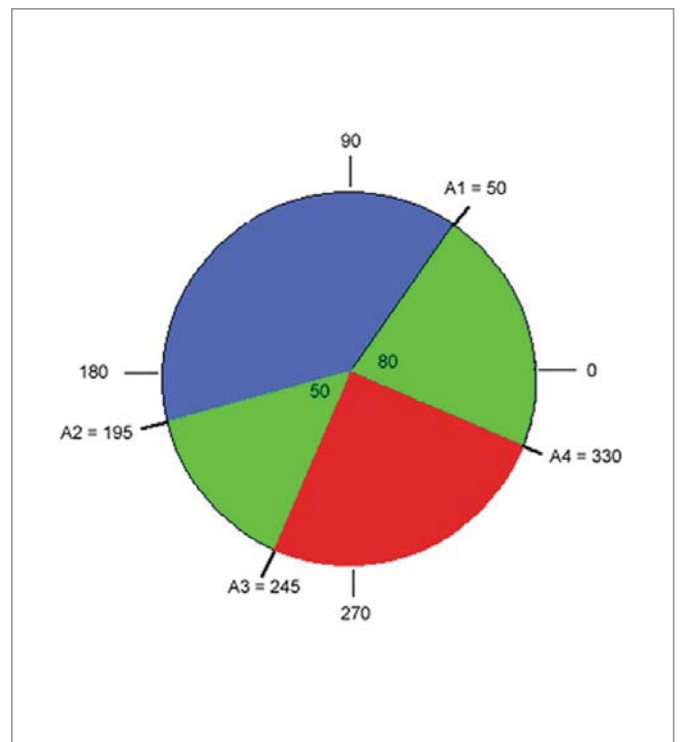
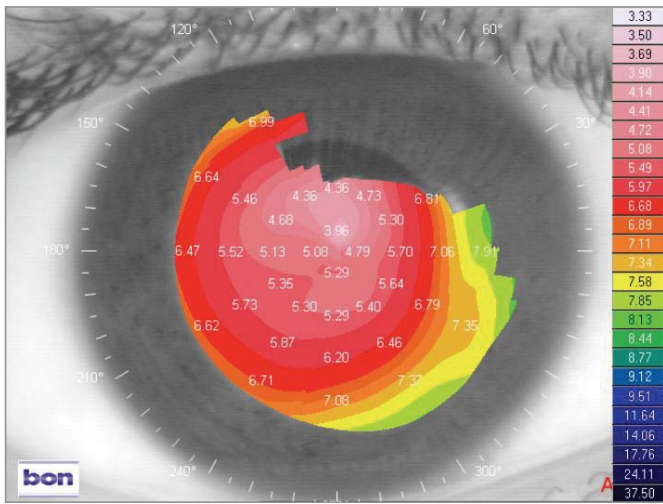


Figure 8. A lens designed to fit a more asymmetric corneal pattern

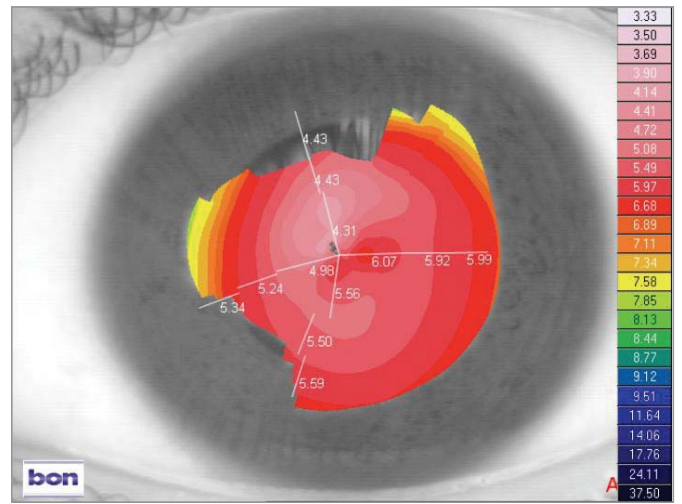
Figure 8 shows an example of a lens designed to fit a more asymmetric corneal pattern. In this example, A1 = 50° measured from the 0-180° line. The other angles are calculated going round anti-clockwise and the blend angles (of 50° and 80° in this example) are automatically derived from the definition of the flat and steep sectors.

The design in this example is therefore ordered as:

- Flat 2 A1 = 50°: A2 = 195°
- Steep 3 A3 = 245°: A4 = 330°



RE topography (absolute)



LE topography (absolute)

Figure 9. Topography images of patient DA

KeraSoft3 case study

Patient DA

DA is a 13-year-old boy – a very good student who developed keratoconus when he was around 10 years of age. It progressed very quickly and quite soon he was unable to see well in spectacles. He was fitted for a time in RGP lenses but developed central scarring and started to lose tolerance. Eventually, he gave up wearing lenses altogether, struggled to see with his spectacles and he was falling further and further behind at school. The only option open to him appeared to be to have corneal grafts.

When he was assessed for lenses, his acuity with glasses was only a very poor R&L 6/36 and he suffered from multiple images and monocular diplopia. His topography images are shown in **Figure 9**.

Fitting

DA was fitted with KeraSoft3 lens to the following specifications:

R: 8.00/14.50/-10.50/-5.00 x 4 VA 6/6

L: 8.0/14.50/-12.50/-3.75 x 10 VA 6/7.5

He was absolutely thrilled with this, as were his parents. He is able to wear the lenses for 14 hours a day in a tropical climate and in air conditioning.

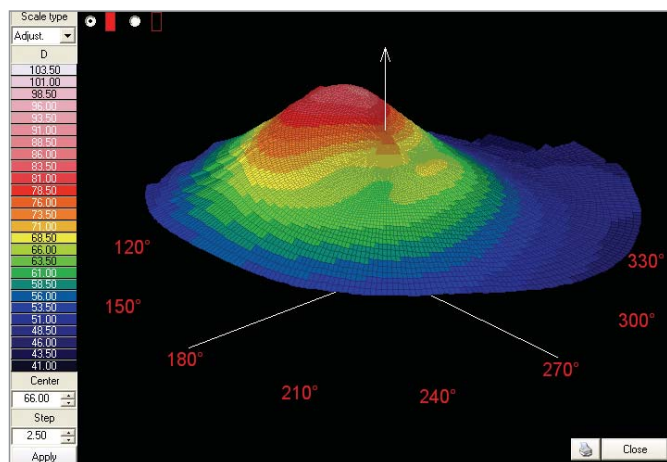
Having the KeraSoft3 lenses made an incredible difference to his life, as for him there were no other options but to struggle to see with spectacles or go out of the country for expensive corneal graft surgery. He is now able to continue his education and lead a normal life.

The pictures in **Figure 10** show the right eye in 3D view before fitting with KeraSoft3 and the same eye with KeraSoft3 in situ. The improvement in shape can be easily seen.

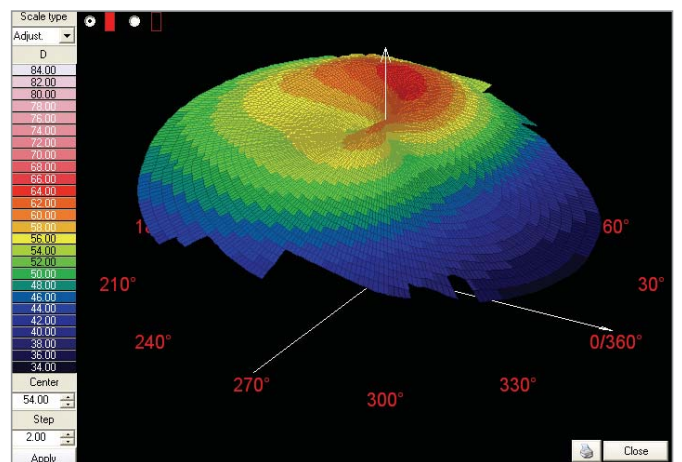
Conclusion

The KeraSoft range of contact lenses has a product to suit each type of irregular cornea. They all offer high comfort, long wearing times and stable vision throughout the day, along with all the health benefits afforded by the silicone hydrogel material. KeraSoft lenses are being fitted to more eyes every day around the world, often bringing the wearer life changing benefits.

To learn more about fitting KeraSoft lenses, visit www.kerasoft3.com and www.ultravision.co.uk. UltraVision's qualified experienced clinical services team are available to discuss KeraSoft products, any aspects of the lens fitting and can provide comprehensive support with complex cases. Telephone Freephone 0800 585115 or email clinicalservices@ultravision.co.uk for more information.



RE 3D view



RE with KeraSoft3 in situ

Figure 10. Patient DA before (left) and after being fitted with KeraSoft3