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How to fit quadrant-specific (R)GP designs

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Introduction

In cases of irregular corneas due to ectasia, fitting (R)GP lenses can be challenging. The contact lens needs to fulfill the visual demands of the patient as well as provide the least physiological impact to the weak cornea. Traditional fitting strategies such as 3-point touch fittings can create significant pressure on the apex of the ectasia, leading to stromal scarring. Another approach is to fit the (R)GP lens on the more stable and healthier peripheral cornea, vaulting the sensitive apex entirely. Fortunately, those designs generally provide a more stable visual acuity as well.

Case Report

Our patient, age 43, was diagnosed with bilateral keratoconus at the age of 20 (Figure 1). Previous (R)GP fittings have failed because of discomfort. As a result, the patient got along with spectacles, but complained increasingly about his insufficient visual acuity.

Michael Baertschi

Michael Baertschi was the senior optometrist at the University Eyehospital Basel from 2000 to 2007. He is the owner of Kontaktlinsenstudio Baertschi in Bern, Switzerland and the CEO of Eyeness AG in Bern. Michael graduated from Pennsylvania College of Optometry as M.Sc. Optom. and from the University of Bern as M.med. Educ. Michael Baertschi is a fellow of the American Academy of Optometry and president of the Swiss Interlens group.

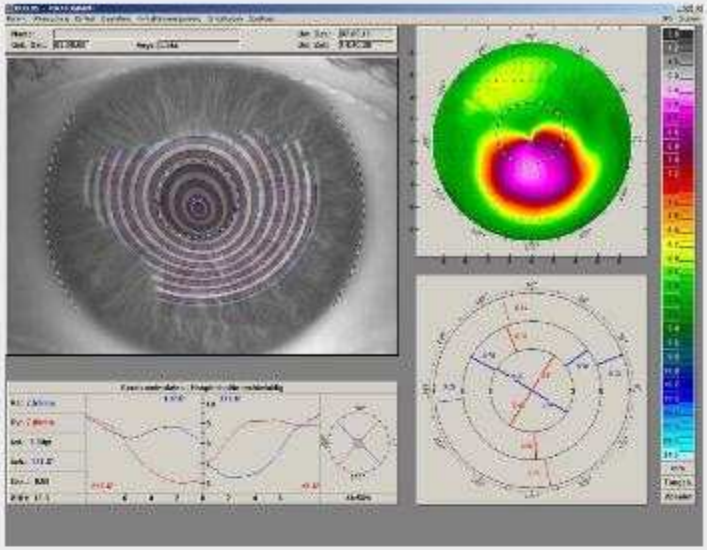

Figure 1: Topography presenting keratoconus grade 3.

The current (R)GP lens, an aspheric, rotationally symmetric design with a 9.30mm diameter, presented with apical touch and inferior lift-off. This made the contact lens extremely uncomfortable and also induced some diffuse stromal scarring (Figure 2).

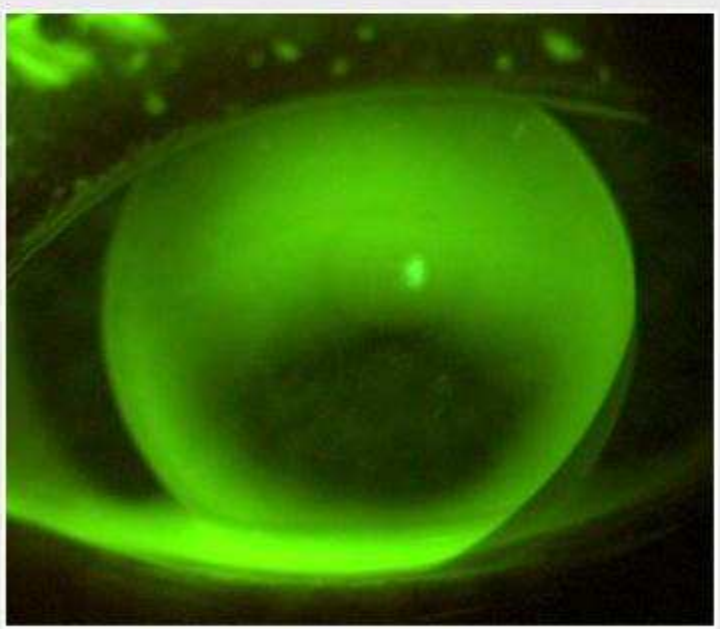

Figure 2: Fluorescein pattern with current aspheric, rotationally symmetric (R)GP.

To achieve better comfort and centration, the lens needs to stabilize in the periphery and so requires a bigger diameter to allow it to click into the peripheral corneal curvature. Quadrant specific lens designs consist of a spherical optic zone and free, definable peripheral curvatures in all four quadrants, providing outstanding centration and crisp clear vision (Figure 3).

Michael Wyss

Michael graduated from Olten SHFA in Switzerland and did his MSc at the Hochschule Aalen Germany (in cooperation with New England College of Optometry and Pacific University, USA). Since 1999 he has worked in a private practice (kontaktlinsenstudio Baertschi in Bern, Switzerland) as Optometrist for specialty contact lens fitting. Additionally, he is an adjunct Faculty Member at the New England College of Optometry USA, Hochschule Aalen Germany, TVCI in Prague (Czech Republic) and FHNW Optometry in Olten Switzerland. Michael is a clinical investigator for several Industry Partners and has published or lectured on several topics in the contact lens field throughout the world. Michael is a Fellow of the American Academy of Optometry and serves as a Member of the Admittance Committee for new Fellows outside the USA.

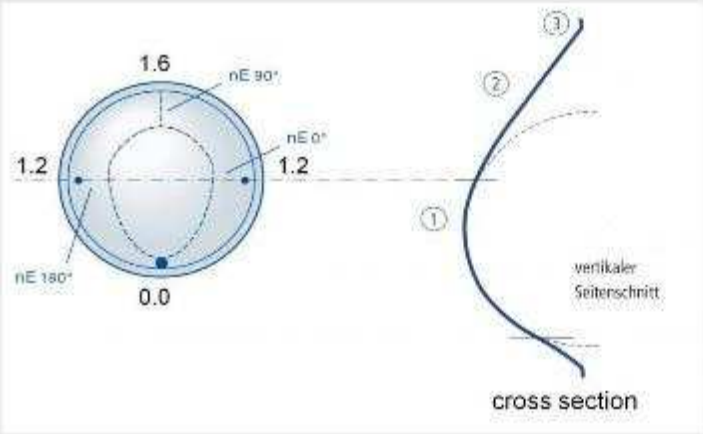

Figure 3: Falco FKQ Quadrant Specific Design, indicating different eccentricities in different quadrants.

The starting point for the fitting process is the steepest curvature in the midperiphery, which is usually inferior in advanced keratoconus. Because the steep quadrant is fitted with a spherical curve (e-value 0), this curvature defines the base curve (BC) of the lens. In our case we will use a BC radius of 6.60mm (Figure 4).

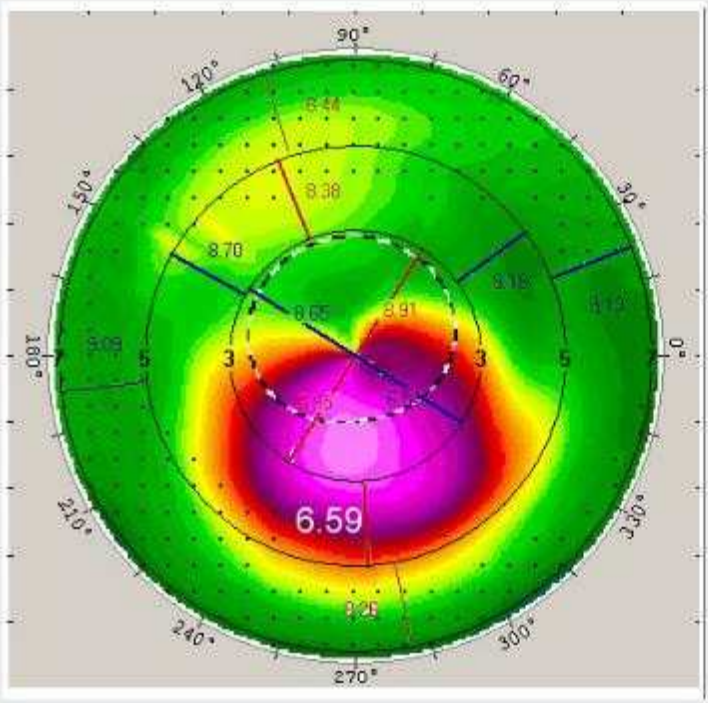

Figure 4: Topography with K readings.

For calculating the e-value for the different quadrants, we need some mathematical calculation. As a rule of thumb, e-values are achieved by taking the square root of the radius difference in mm. In our example, we have a difference between the steep quadrant (6.60mm) and both horizontal quadrants (9.10mm) of 2.5mm; taking the square root results in an e-value of 1.6. To achieve alignment in all quadrants, using the above calculation, the e-value needs to be 1.6 horizontal and 1.4 superior. These calculations resulted in the following contact lens ordered from Falco Kontaktlinsen (Switzerland): FKQ 16/16/14/00 (indicating the e-value in 4 quadrants) base curve 6.60mm with a diameter of 10.80mm. This resulted in a perfectly centered contact lens (Figure 5).

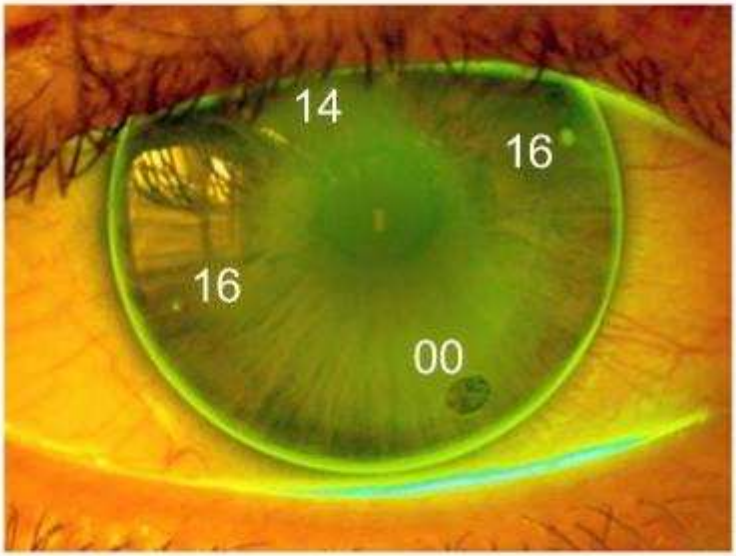

Figure 5: Quadrant specific (R)GP Design.

The patient reports this lens to be much more comfortable to wear and to actually provide better vision as well. The fluorescein pattern shows a typical picture with apical vaulting and some pooling zones in the midperiphery of the steep meridian, almost like a peripheral toric lens design. The two 'dots' near the lens edge in the photo illustrate the flattest meridian. The black colored engraving at 270° guides the patient when applying the lens. It is important that the periphery demonstrates alignment in all quadrants and perfect close down in the 270° direction, otherwise the lens has the freedom to rotate.

Discussion

Fitting ectasia with a quadrant specific lens can greatly improve comfort and vision for the patient. But using such contact lens geometries means a paradigma shift in our fitting strategies. Quadrant specific lens designs consist of a spherical optic zone and free definable peripheral curvatures in all four quadrants, providing outstanding centration and crisp, clear vision.

The most important fitting pearl is to concentrate first on the steep peripheral quadrant instead of on the central K readings. This sounds almost in violation of what we know about fitting (R)GPs, but it makes fitting irregular corneas so much easier and provides a more stable fit.

The need for a larger diameter when fitting quadrant specific (R)GP designs is obvious and cannot be overstated. If the haptic of the contact lens is too small, the periphery will not click into the corneal curvature and the fitting will fail. Oxygen supply is no longer an issue with the hyper gas permeable materials available today. So be brave and go big!

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