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Meeting the Challenge of the Irregular Cornea

Corneal topography has become an indispensable tool in designing contact lenses for patients with keratoconus, keratoglobus, pellucid marginal degeneration, contact lens-induced corneal warpage, or corneal irregularities following penetrating keratoplasty, refractive surgery and trauma. Topography enables practitioners to determine the size, shape, and location of the irregularity and, when used along with a diagnostic fitting set, to save chair time for themselves; staff time by minimizing lens exchanges; and to maintain a high level of patient confidence by achieving an optimum lens/cornea fitting relationship in a shorter period of time.

The detection of corneal irregularities has increased now that refractive surgery has become a common form of vision correction. Patients who were able to achieve good visual acuity with glasses or soft contact lenses often made an appointment with a refractive surgeon, hoping that LASIK, PRK, or some other refractive procedure will improve their vision. Since corneal topography and pachymetry are part of the standard workup for the refractive surgery candidate, keratoconus and other corneal ectasias may be uncovered that explain the patient's inability to see well.

...generally provide a flatter base curve...

Analysis of topography maps reveals that many corneal ectasias are inferior, rather than central, making fitting more challenging. Patients with pellucid marginal degeneration; large, sagging, oval cones; or keratoglobus may require large, limbus-to-limbus lens designs. Even these, however, may exhibit inferior edge standoff, causing discomfort and even lens displacement as the lens interacts with the lower lid during the blink cycle. Advances in lathing technology now enable fitters to request quadrant specific lens designs to accommodate the corneal asymmetry that occurs frequently in the inferior portion of the cornea. These lenses generally provide a flatter base curve superiorly to align with the more normal, superior cornea, and a steeper base curve (and steeper edge lift, if needed) inferiorly to provide a better lens/cornea relationship, better stability, better comfort, and better visual acuity.

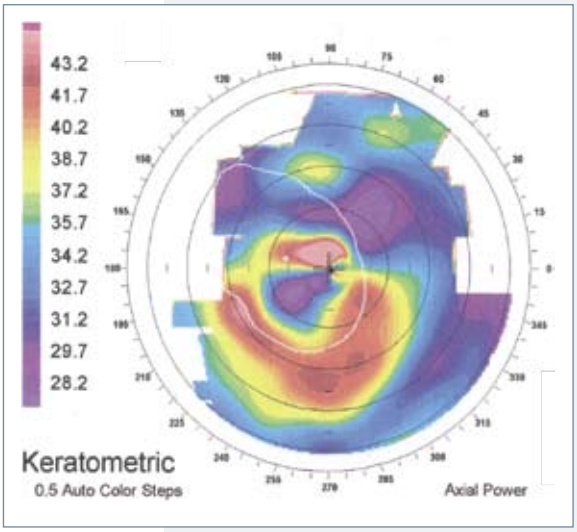

Figure 1.

Some laboratories are not only able to produce lenses that are steeper inferiorly, but can actually vary the base curve radii in any or all of the four quadrants. The edge lift can also be made several steps flatter or steeper than the standard edge lift in any or all of the four quadrants. When necessary, the base curve and peripheral curve designs can be combined.

The following two case histories illustrate how quadrant-specific GP lens designs have enabled fitters to provide patients with significant corneal asymmetry:

Case 1

Patient I.D., an 89-year-old male, developed bullous keratopathy in his right eye following cataract surgery. He underwent penetrating keratoplasty in 1999 and failed to achieve success at that time with gas permeable lenses due to inferior stand-off and discomfort from the lens/lid interaction every time he blinked. In spite of his age, this former school administrator was determined to be refit with rigid lenses to improve his vision. His topography illustrates the post-PKP inferior ectasia .

We tried, initially to fit I.D. with a Rose K2 Post-Graft lens with a base curve of 44.50 (7.60 mm) and diameter of 10.4 mm, but although the lens centered well, there was seal-off in the mid-periphery. Best-corrected visual acuity (BCVA) was 20/50±. We flattened the base curve to 43.87 (7.70 mm) and kept the diameter at 10.4 mm. This lens centered well, with feather touch in the ecstatic area, good alignment in the mid-periphery, but

slight edge stand-off inferiorly. We asked the laboratory for a Grade I steepening in the inferior quadrant between five and seven o'clock. This maintained the good lens/cornea relationship that had been achieved throughout most of the lens, eliminated the inferior stand-off, and enabled I.D. to achieve good comfort and maximum visual acuity.

Case 2

Patient W.M., a 44-year-old male, presented with advanced keratoconus OS and expressed interest in a corneal transplant. He was a contact lens failure, and, as an athletic coach in an elite private high school, needed better vision to function at work. Due to previous problems with lens comfort, a piggyback fit was suggested.

An 8.4 mm base curve, 14.0 mm diameter, -0.50 diopter Acuvue Oasys lens was used as the carrier, due to its very high Dk value. A super permeable Rose K lens in the Boston XO material with a base curve of 6.70 mm and diameter of 9.3 mm fit on top of the Oasys. This lens was well-aligned centrally, but demonstrated moderate inferior edge standoff. We maintained the 6.70 mm base curve and 9.3 mm diameter, but ordered Grade II steepening in just the inferior quadrant. This eliminated the stand-off, and provided good comfort. Both the soft and gas permeable lens moved and centered well and W.M. achieved 20/30± vision and full-time lens wear. He is no longer interested in proceeding with a corneal transplant.

The availability of high Dk GP materials has enabled us to fit large diameter lenses and maintain good corneal physiology, even with piggyback lenses or on patients with compromised corneas. In the following case, a patient with a surgically-altered, highly irregular cornea was able to achieve an excellent fit and almost 20/20 visual acuity with a limbus-to-limbus GP design.

Case 3

…complained of severe ghosting…

G.M., a 48-year-old female with strabismus and a deeply amblyopic right eye, underwent radial keratometry (RK) in 1996 in her left eye only. This was followed by an astigmatic keratometry procedure (AK) to try to eliminate some of the post-operative astigmatism. The astigmatism gradually returned, and G.M. had LASIK in 2005 in an attempt to reduce the astigmatism. She complained of severe ghosting OD and vision that fluctuated throughout the day.

Evaluation of the topography indicated the need for a large diameter GP lens. We inserted a Rose K 2 IC (Irregular Cornea) lens with a base curve of 8.44 mm (40.00 diopters,) diameter of 11.2 mm, and standard peripheral curves. This lens, which incorporated a small amount of reverse geometry in its design, centered perfectly and aligned well with her highly irregular cornea. Visual acuity achieved was 20/20-2.

In order to successfully manage challenging contact lens patients, practitioners need to be informed of the state-of-the-art technology that has emerged in lens materials and designs. Laboratory newsletters and good consulting services will increase fitter awareness of the numerous options that are now available and help them to develop the skills that are needed to fit the myriad of corneal irregularities that we see in our day-to-day practice.

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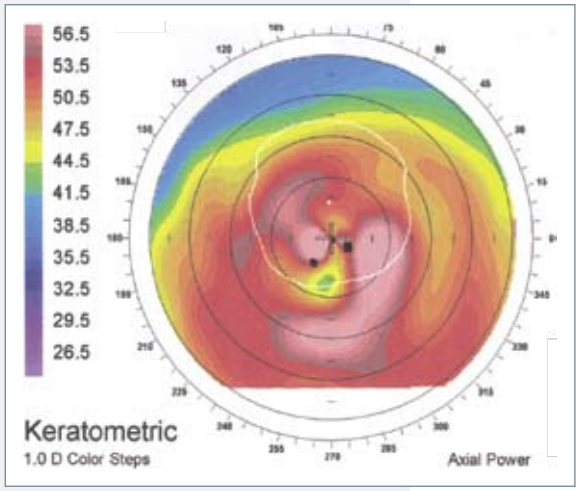

Figure 2.

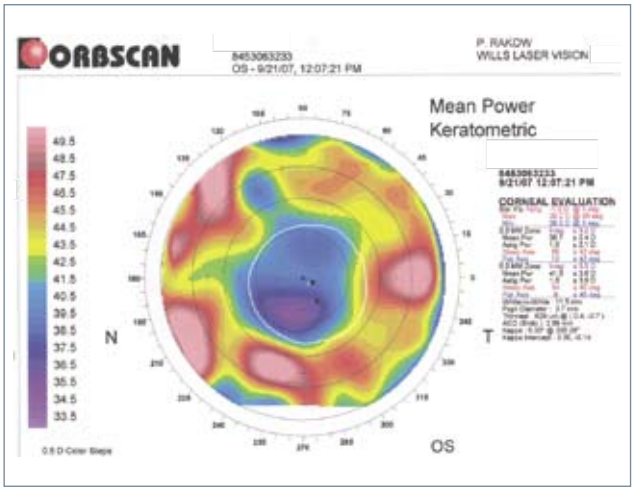

Figure 3.