One and Done: Using Custom Contact Lens Software to Create Free Form Lenses for Corneal Irregularity

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Introduction:

Pellucid Marginal Degeneration is a multifactorial corneal ectasia that involves progressive thinning of the peripheral cornea, resulting in distorted vision. While traditional visual corrections are utilized for some patients, there are sometimes limits to vision that are reached due to the irregularity of the cornea. Gas permeable lenses provide improved vision for the patient that may not be achieved with glasses or soft contacts. However, high asymmetry and corneal irregularity can make fitting these lenses particularly challenging. With the use of custom software programs, a more comfortable custom, freeform fit can be achieved quicker with the ability to make micro-adjustments and computed predictions of lens parameters customized to each patient.

Case History

A 54 y.o. AA female presents for a scleral lens fitting. With a history of PMD, she has only tried glasses in the past and never has been fit in contact lenses. The patient's entering acuities are 20/100 OD, 20/80 OS.

CL Findings:

Trial Lens #1
OD: Rose K2
BC 7.50/Dia 9.2/Pwr -2.00

OS: Rose K2 IC
BC 8.04, Dia 11.2, Pwr -1.00

Fluorescein showed central bearing with zones of pooling and midperipheral seal off consistent with the asymmetry observed on Pentacam

Plan: Order custom WAVE CornealLens GP lenses with topography scans

Trial Lens #2
OD: WAVE CornealLens
Dia 9.8/CT 0.25 OR: -3.25 sph, BCVA20/30+
Fit: slight bearing over apex
Plan: Steepen BC, add OR, increase center thickness

OS: WAVE CornealLens
Dia 9.8/CT 0.18
OR: pl, BCVA 20/25
Fit: slight bearing over apex
Plan: steepen BC, VA OU: 20/25

Trial Lens #3
OD: WAVE CornealLens
Dia 9.8/CT 0.25
OR: pl, BCVA 20/30+
Fit: Acceptable fl. pattern
Plan: Dispense lens

OS: WAVE CornealLens
Dia 9.8/CT 0.18
OR: pl, BCVA 20/25
Fit: Acceptable fl. pattern
Plan: Dispense lens VA OU: 20/25

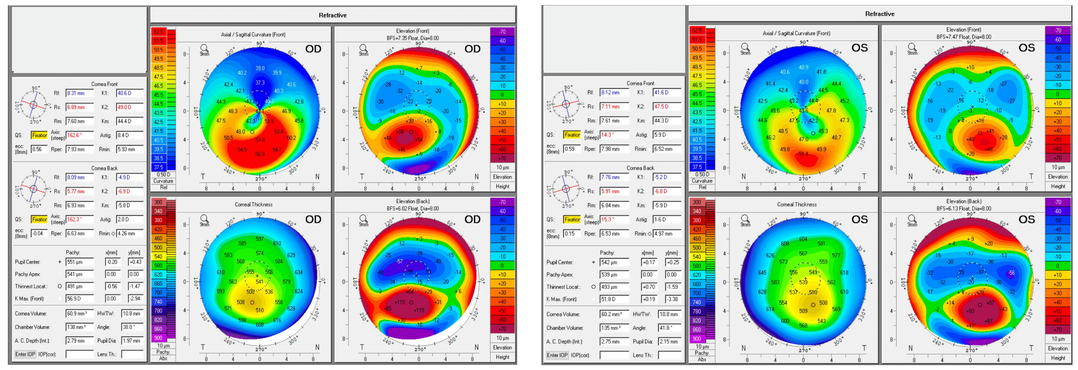


Figure 1 and 2. Pentacam topographic scan, OD (right image) and OS (left image), showing Pellucid Marginal Degeneration. A large difference in keratometry difference with great inferior steeping in the classic "kissing doves" appearance can be seen typical of Pellucid Marginal Degeneration.

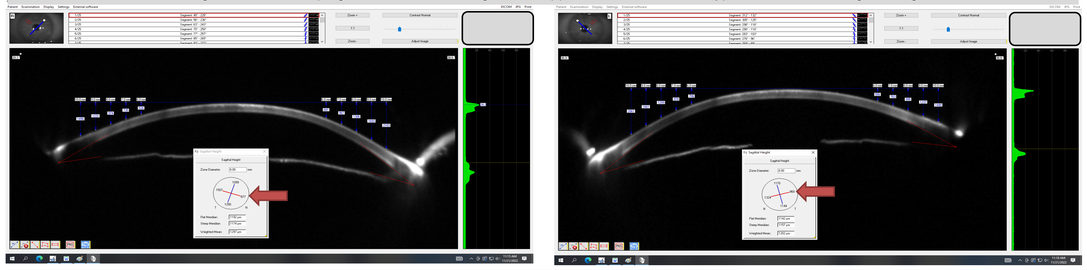


Figure 3 and 4. The above images showcase the Scheimpflug maps OD (right image) and OS (left image). As displayed by the arrows, a difference in elevation is seen along various quadrants.

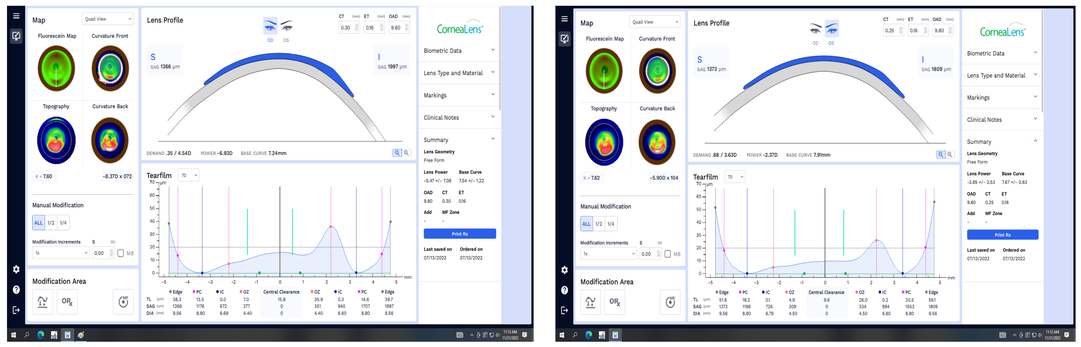


Figure 5 and 6. The above images display the WAVE program for freeform Gas Permeable CornealLens OD (right) and OS (left). Lens parameters can be adjusted in the bottom field to generate desired tear layer clearance including and not limited to the optic zone, peripheral curve, edge lift, etc. A basic fluorescein map is also displayed to show on potential on-eye appearance, comparing the lens surface to the topographic elevation.

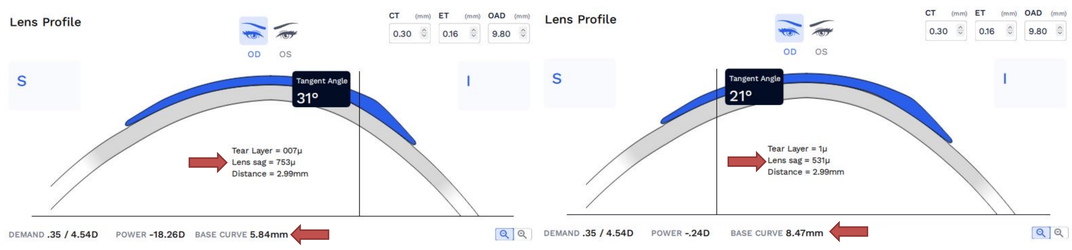


Figure 7 and 8. As seen in the above images, the difference in base curves and lens sagittal heights are displayed along 3 mm both inferiorly and superiorly on the right lens. The righthand side image displays the inferior cross section of the CornealLens while the lefthand side picture displays the superior cross section of the CornealLens. A difference of 222 microns can be seen between the sagittal height differences and a change in base curve from 8.47mm to 5.84mm can be seen. This achieves a freeform fit design.

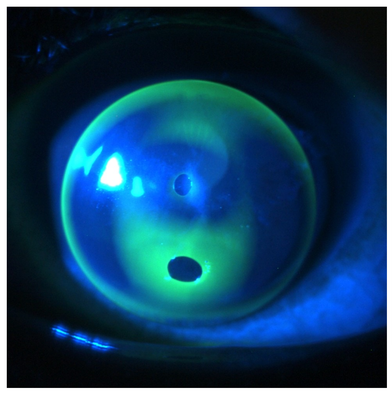
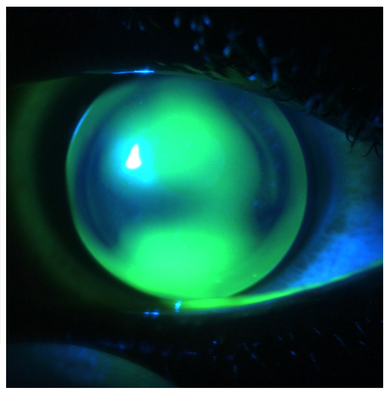


Figure 9 (left) and 10 (right). The image on the left shows the initial Rose K2 Gas Permeable lens OD. The fluorescein pattern reveals central bearing with midperipheral seal off and noticeable pooling inferiorly. Thinner edges are also seen due to the poor fitting cornea lens relationship. The image on the right shows the final CornealLens on eye. A "touch with flush" fluorescein pattern is seen with adequate tear exchange present centrally upon the patient blinking. Edges have a more adequate thickness as well as an acceptable fluorescein pattern.



Discussion:

Corneal Gas Permeable lenses can be applied to correct vision in patients with corneal ectasias. Typically, a diagnostic fitting set is used, such as the Rose K2 at our initial visit. As seen in Figure 1 and 2, there is a great difference in keratometry values due to Pellucid Marginal Degeneration. Figure 3 and 4 also showcases the difference in elevation among the various quadrants, which can prove to be a challenging parameter to fit a gas permeable lens. When initially fitting the Rose K2 diagnostic lens, an inadequate fluorescein pattern was seen as seen in Figure 9. With the WAVE program (Figure 5 and 6), we are able to create a freeform lens containing variable curves and sagittal height differences throughout the lens based on the patient's topographic maps. The arrows highlight the the specific sagittal height and base curve measurements to compliment and correspond with the varying keratometry values seen superiorly and inferiorly on the patient's initial measurements. A more customized approach can be taken with potential to change lens thickness, edge lift, peripheral curves, optic zones, etc. With this technology, a precisely fitting gas permeable lens with adequate power incorporation and fitting parameters can be achieved in an efficient manner for the patient, maximizing comfort and minimizing chair time.

Conclusion:

Pellucid Marginal Degeneration is just one example of the challenge asymmetric corneas can cause when fit into gas permeable lenses. The advantage provided with the WAVE program is the ability to achieve an acceptable fit of the gas permeable lens to help centration and optics with the varying and customized lens parameter changes per patient. WAVE allows various base curve changes and sagittal height difference along with adjustable haptics to contour the patient's cornea. Freeform lenses allow and compensate for fluctuating keratometry and elevation values of asymmetric corneas. This gives better centration of the lens with a more customized and efficient lens fit.

References:

Please contact for references and we will be happy to share.