Peripheral corneal data is highly relevant

Dr Rolando Ortiz, OD; Reinier Stortelder, B Optom; Arnoud Snepvangers

Introduction

The current Paragon CRT Calculator (CooperVision® Specialty EyeCare) uses central keratometry (CK) readings to calculate the full posterior surface of the Paragon CRT® lens. Several authors[1, 2] have shown that the shape of the peripheral cornea does not have a good correlation with the CK. The Landing Zone Angle (LZA) is the most peripheral section of this lens, helping to stabilize and center the contact lens.

This research compared the final fitted LZA of the Paragon CRT with two methods of empirical designing. The first method used the CK values and the CRT Calculator (CRTcalc). Method two used sagittal height values (SAG) based calculations of the Eye Surface Profiler (ESP, Eaglet Eye) and a proprietary algorithm to calculate the LZA.

Methods

For 28 eyes the CK readings were measured with an auto-refractor (ARK-1, Nidek). The CK values were entered into the CRT Calculator (www.crtcalculator.com) to calculate the LZA for the flat (LZA1) and the steep (LZA2) meridian (Figure 1).

For the same 28 eyes corneo-scleral measurements were taken with the ESP. The LZAs were calculated using First Lens Fit algorithms that use SAG values measured in the peripheral part of the cornea (Figure 2). The LZA values from the ESP prediction (LZA1 and LZA2) were collected.

The patients were fitted with the Paragon CRT lenses predicted by the CRTcalc and corrected until good centration and correction was achieved. The LZAs of the final fitted lenses were collected. The number of refits has not been considered.

Results

- The final fitted LZAs ranged from 30 to 35 degrees. The CRT calculator predicted LZAs ranging between 32 and 34 degrees, while the ESP predicted LZAs within the range of 30 to 35 degrees.
- The ESP correctly predicted both LZAs in 61% of the cases. In 96% of the cases for the flat LZA and 89% of the cases for the steep LZA, the ESP prediction was the same or 1 step too steep in comparison with the final fit
- The CRTcalc predicted the LZAs correctly in 21% of the cases. In 71% of the cases for the flat LZA and 50% for the steep LZA, the CRTcalc prediction was the same or 1 step too steep or too flat in comparison with the final fit. 50% of the LZA1s and 29% of the LZA2s needed to be steepened 2, 3 or even 4 degrees to get to the final fit.
- The standard deviations for the CRTcalc were 1.14 and 0.83, while those for the ESP with 0.56 and 0.72 for LZA1 and LZA2 respectively.
- Both algorithms tend to predict the fitting too flat. CRTcalc estimated the LZAs as being 1.39 and 1.14 steps too flat, whereas the ESP exhibited a discrepancy of 0.43 for both LZAs.

Conclusion

This study confirms that CK is not a good predictor of the peripheral shape of the cornea. Using CK as the only parameter to design an orthokeratology lens may not be accurate enough and is not the most precise method available nowadays. Furthermore, this study demonstrates that utilizing SAG values or a mathematical model derived from SAG may lead to empirical algorithms that achieve a higher first lens fit success rate. Using real elevation data of the peripheral cornea can reduce the number of refits for the Paragon CRT orthokeratology lens and the chair time. This study could be repeated with larger sample sizes and involving multiple fitters to minimize fitter bias.

Lens calculations

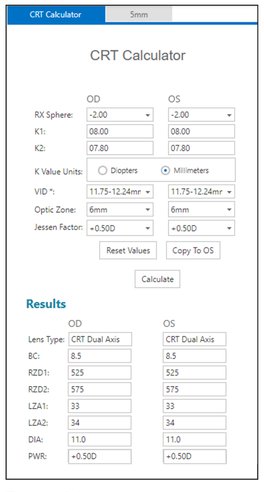

Figure 1 Lens prediction based on CK with the *CRT Calculator*

Figure 2 *First Lens Fit* prediction based on SAG and fluo simulation with the Eye Surface Profiler

Lens predictions vs. final fit

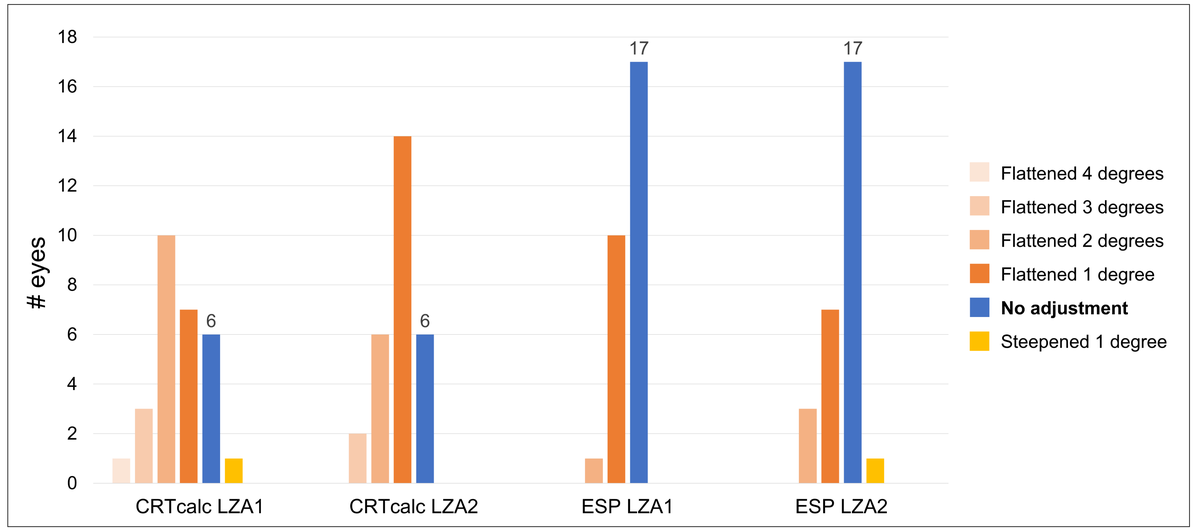

Figure 3 Flattened or steepened n-degrees needed from the predicted lens (CRTcalc and ESP) and the final lens.

References

[1] Elevate your Ortho-K Fitting to the Next Level; Nicholas Gidosh, OD; Bruce Morgan, OD; Craig Norman; Contact Lens Spectrum; Dec 2017.
[2] Effects of Corneal Eccentricity; Patrick J. Caroline, FAAO; Mark P. André, FAAO; Nov 2010.

Financial disclosures

– Rolando Ortiz has his own private practice and has no financial interest; rortizod@gmail.com
– Reinier Stortelder and Arnoud Snepvangers are employed by Eaglet Eye; info@eaglet-eye.com