NOVEL SCLERAL LENS DESIGN WITH ELLIPTICAL AND TORIC CORNEAL AND LIMBAL ZONES

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Purpose

To present a successful clinical case fit with a full toric scleral lens (SL) with elliptical corneal and limbal zones.

Background

Fitting a round SL in a case with prominent oval limbus, the lens will land near to the limbus in the horizontal meridian and far from the limbus in the vertical meridian creating a large clearance inferiorly. Also, the presence of high corneal toricity with significant corneal elevation difference may cause an excessive clearance in the areas of the cornea that are the lowest in elevation. Excessive clearance inferiorly may cause debris entrance into the fluid reservoir, conjunctival prolapse, lens decentration, stem cell breakdown and discomfort.

To a better distribution of clearance in the chamber, SLs may be full toric and the diameter may be designed with different internal zones widths in the two meridians, 180° and 90°. Corneal and the limbal zones may be elliptical with the landing zone compensating the oval shape of these two inside zones. Consequently, the last peripheral zone is circular.

Methods

FDO years-old with high corneal astigmatism. Rx: OD sph -2.00 cyl -2.75 ax 175; OS sph -3.00 cyl -5.00 ax 175 . VA OU 20/20.

The patient is a sporty young man asking for comfortable contact lenses which offer the best and stable visual acuity.

Horizontal (HVID) and vertical (VVID) visible iris diameter were different (0.35mm). The oval profile of the limbus associated with a high corneal astigmatism and corneal elevation difference along the greater meridian of change have suggested the necessity of full toric SLs with oval internal zones.

The SLs have been designed personally. SL total diameters (TD) were calculated following these formulas:

$TD_H = HVID + limbal\ ZW\ (x2) + LZW_H\ (x2) + LPZW\ (x2)$

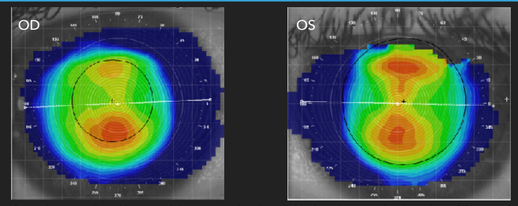
$TD_V = VVID + limbal\ ZW\ (x2) + LZD_V\ (x2) + LPZW\ (x2)$

Where TD_H is the horizontal TD, TD_V is the vertical TD, LZD_v is the vertical landing zone diameter and it is calculated referring to the horizontal landing zone diameter (LZD_H):

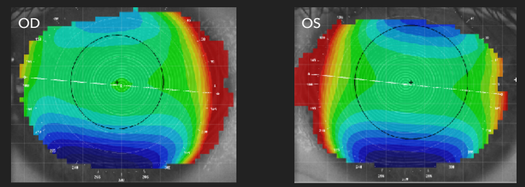
$LZD_V = LZD_H + (HVID - VVID)$

Where $LZD_H = LZW_H \times 2$

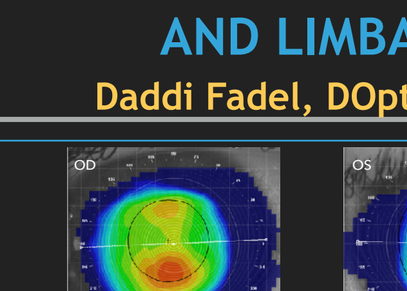
In this design the limbal and the last peripheral zone widths have the same value in the two meridians while the values of HVID, VVID and LZD are different in horizontal and vertical meridians. The landing zone diameters compensate the oval shape of the corneal and limbal zones, leading to a "round" lens.



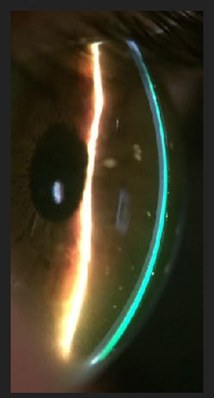
Corneal topography with tangential curvature showing a with-the-rule corneal astigmatism (OD 2.82D; OS 4.80D).



Elevation maps showing a significant corneal elevation difference (≈400μm). The red portions of the elevation map represent areas of the cornea that are higher in elevation. The blu portions represent the cornea that are lowest in elevation.



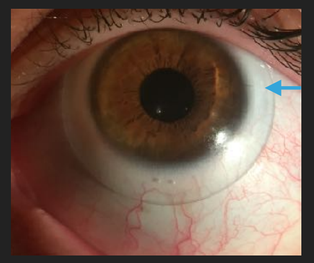
Toric scleral lens decentered with high clearance inferiorly.



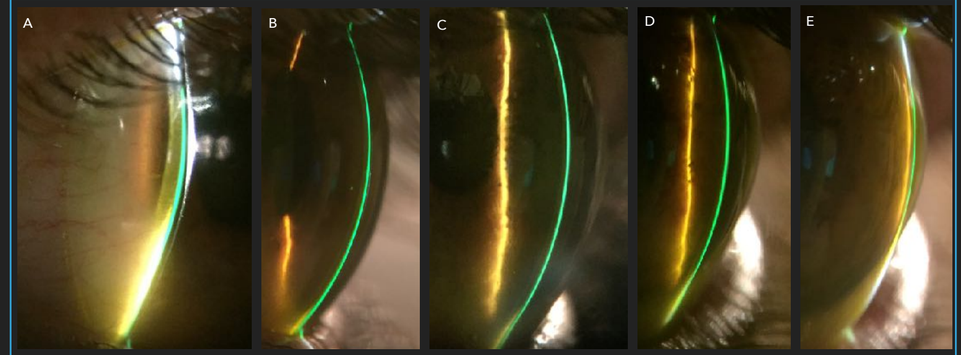
Optical section showing prismatic fluid layer and presence of debris in the fluid reservoir causing discomfort and reduced visual acuity.

Results

Full toric scleral lens with oval corneal and limbal zones. The SL have also a dynamic stabilization.



The full toric scleral lens with oval corneal and limbal zones fit on the eye. The lens is well centered and stable with an optimal alignment relationship on the conjunctiva offering a VA 20/18 OU. The laser marks in the horizontal meridian show the optimal stabilization.



Clearance thickness evaluation with optic section. The figures show the same thickness of the fluid layer in all the areas in the corneal and limbal zones. A: Corneal peripheral and limbal clearance in the nasal area. B: Corneal center, superior and inferior clearance and limbal inferior clearance. C-D: Center, superior and inferior clearance in the mid peripheral cornea and limbal inferior cleaance. E: Corneal peripheral and gimbal clearance in the temporal area.

Discussion

Corneal topography during SLs fitting is generally used with the SL on the eye detecting the lens flexure and its optical quality. These clinical findings appear to indicate that it may be suggested to perform corneal topography prior SL fitting to predict an excessive clearance pooling inferiorly and, consequently, to determine whether SL necessitates toric or spherical corneal and limbal zones.

This novel SL design allows the same corneal and limbal clearance in all meridians resulting in optimal alignment on the conjunctiva, centered and stable SL and offering better comfort.

In cases with high corneal toricity and significant difference of elevation between the two principal meridians, it may be necessary a full toric SL (corneal, limbal and haptic zones). A better distribution of corneal and limbal clearance allows a better fitting relationship and prevents debris influx into the fluid reservoir, conjunctival prolapse, lens decentration, stem cell breakdown and discomfort. Furthermore, this design seems to alleviate the pressure of the SL on the conjunctival tissue allowing an optimal alignment.

The author proposes an additional clinical guideline, to measure HVID and VVID prior fitting SLs to avoid a high clearance height in the inferior area.

Acknowledgments

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