Clinical Application of Vertical Prism in a Customized Soft Multifocal Toric Contact Lens

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Purpose
This case examines the optimization of multifocal optics and the integration of additional amounts of vertical prism in a soft multifocal toric contact lens to reduce asthenopia and diplopia and enhance visual performance.

Patient Measurements

Simulated Keratometric (K) Readings:
OD: 43.49 @107/43.76 @017
OS: 43.55 @65/43.53 @155

Manifest Refraction:
OD: -0.25 -2.25 x100 +1.00 add
OS: -1.00 -1.50 x068 +1.00 add
DVA: 20/20 | NVA: 20/20

Pupil Size Measurements (Nidek OPD Scan III):
OD: 4.24mm photopic | 5.65mm mesopic
OS: 4.11mm photopic | 5.86mm mesopic

An effective pupil size of 4.9mm was calculated as the patient’s pupil size measurement. Standard prism ballasting (1.0 prism diopter base down) was used to stabilize the toric multifocal contact lenses, and the prism was customized to address vertical deviation.

Vertical Deviation:
OD: +1.75 prism diopeters base down

Methods

The subject of this case report is a 41-year-old Caucasian male who was fitted in simultaneous design, center-near, custom soft toric multifocal contact lenses in both eyes. The lens design parameters (base curve, diameter, and multifocal optic zones) were customized based on an average horizontal visible iris diameter (HVID) value and the patient’s simulated keratometric readings and pupil size.

The base curve and diameter of the lenses were designed using the SpecialEyes Arc Length Calculator. Power was determined based on the patient’s manifest refraction. The custom multifocal optics (near-center and peripheral zone sizes) were initially chosen based on prior experience with this lens design. During the fitting process, the multifocal optics were optimized according to the SpecialEyes Multifocal Simulator results and the patient’s pupil size measurement. Standard prism ballasting (1.0 prism diopter base down) was used to stabilize the toric multifocal contact lenses, and the prism was customized to address vertical deviation.

Results

During the initial trial contact lens dispense and follow-up, the patient expressed a chief complaint of blurred vision at near and intermediate viewing distances. Near visual acuity of J4 confirmed this issue. A slit-lamp examination revealed that the lens-fitting characteristics were optimal, proper lens movement was observed, and the lens surface was clean and free of defects.

The next trial lens design began with referencing pupil size measurements and redesigning the multifocal optics. The patient’s 4.9mm effective pupil size measurement and add power were input into the SpecialEyes Multifocal Simulator to assist in the redesign of the multifocal optics to improve visual performance. The Multifocal Simulator suggested a 2.2mm near-center zone size and a 4.4mm peripheral zone size. The near-center zone was modified to a slightly larger 2.4mm size since the prior trial lens had a near-center zone size of 2.2mm and the patient was seeing J4 at near with that lens. Increasing the near-center zone size provided more near optics over the patient’s pupil diameter area and improved near vision. The peripheral zone size was also modified to 4.5mm, which reduced the rate at which the intermediate powers progressed (decreased eccentricity) and resulted in improved intermediate vision.

While optimizing the multifocal optics did improve visual performance for the patient, he still experienced a visual disturbance. He complained that his eyes were not working well together and that “things were floating” at distance and near. A vertical deviation was determined using dissociated phorias, and this finding was successfully integrated in the lens design by customizing prism. The third set of trial lenses increased base-down prism in the right lens from 1.0 diopter to a total of 1.75 diopters to address the vertical deviation. As a result of the prism customization, the patient experienced improved binocularity and enhanced visual performance.

Conclusions

1. Optimizing the near-center zone sizes and peripheral zone sizes of the multifocal optics based on pupil size proved successful in improving visual acuities for the patient.

2. Incorporating additional base-down prism in the right contact lens addressed the vertical deviation and further improved binocularity and visual performance.

Discussion

A fully customized, soft multifocal contact lens design with customizable base-down prism provides encouraging results for patients with vertical deviation. Optimizing the multifocal optics according to the patient’s pupil size improved near and intermediate vision. This case report demonstrates the success that is possible with a customized multifocal lens design to achieve a positive outcome for patients.

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