Prism Ballasted Front Surface Toric RGP's:

Rotational effects as a function of the base curve

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Abstract

Studies have suggested that it is difficult to predict the final position of the prism base when fitting a prism-ballasted front surface toric RGP. This study was designed to assess the effect the base curve to cornea fitting relationship has on the rotation of prism-ballasted front surface toric RGP's. Twelve subjects wore lenses fit on K, 0.50D steeper than K and 0.50D flatter than K. Each fit was then measured for amount of rotation. The results indicate that fitting a prism-ballasted front surface toric RGP on K or 0.50D steeper than K produced less rotation than fitting this type of lens 0.50D flatter than K.

Many lens designs have been created in an effort to correct residual astigmatism. One of these designs is the prism-ballasted front surface toric RGP. While this lens is used for the correction of residual astigmatism, it is often difficult to assess or predict the amount of rotation of the prism base and influence of the lower lid on nasal rise. A study conducted by Fairmaid (1967) suggests that the influence of the lower lid on nasal rise accounts for 10-15 degrees of rotation. In 1964, Goldberg concluded we could predict that a prism-ballasted front surface toric RGP will have a final prism base position 20 degrees nasally. In contrast to Goldberg's finding, Westerhout (1971) demonstrated that the prism base would position itself only 10 degrees nasally.

In order to help practitioners correct residual astigmatism by the use of prism-ballasted front toric RGP's, it is necessary to predict consistently the final position of the prism base. It is the intent of this study to incorporate the idea of predicting the final position of the prism base by examining base curve to corneal fit and the effect that this has on rotation of the lens.

Methods

A prism-ballasted front surface toric RGP diagnostic lens set was used in this study. The set consisted of ten lenses with the list of parameters seen in Table 1. Each parameter was checked for accuracy before the study was conducted.

Twelve subjects were then chosen for this project. Each subject had keratometry readings commensurate with the experimental diagnostic lens set. That is, each individual could be fit on K (ONK), 0.50D steeper than K (STK) and 0.50D flatter than K (FTK). Table 2 summarizes the keratometry readings for each patient.

After individual keratometry readings were taken, appropriate base curves were selected that allowed for fits of ONK, STK and FTK. Each subject's right eye was fit ONK while their left eye was fit 0.50D FTK. After ten minutes of wear the lenses were measured for amount of rotation and stability.

Each lens was dotted on the center of the prism base. Rotation of the lens was measured by placing an optical section beam of the slit lamp through the center of the dot and measuring the degrees of rotation from the protractor on the light source. After readings were recorded for each eye and the lenses removed, the right eye was then fit 0.50D steeper than K. Then the same procedures ensued, ultimately producing data that showed amount of rotation as a result of the base curve to cornea relationship.

Results

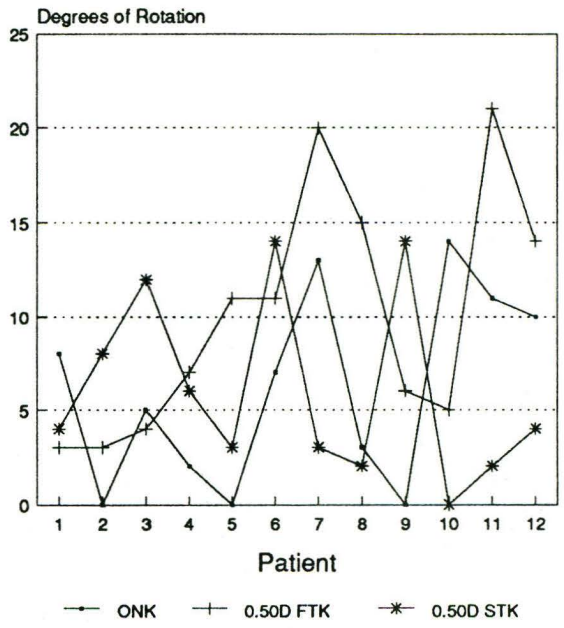
The findings of this study show that fitting a prism-ballasted front surface toric lens ONK or 0.50D steeper than K will produce the greatest stability and the least rotation. Fitting this type of lens flatter than K will produce excessive rotation and decreased stability.

A lens fit ONK rotated an average of 6.1 degrees and moved nasally 92% of the time.

A lens fit 0.50D STK rotated an average of 6 degrees and moved nasally 58% of the time.

In comparison, a lens fit 0.50D FTK rotated an average of 10 degrees and moved nasally 67% of the time.

Figure 1



The amount of lens/base rotation per patient as a function of the base curve to cornea fitting relationship.

Discussion

The results of this study indicate that base curve to cornea relationship does play a role in the final position of the prism base. The data suggests that to provide the least amount of rotation, one should fit a prism-ballasted front surface toric RGP ONK or STK.

It seems that fitting ONK or STK partially eliminates rotational effects of the lids seen when a lens is fit FTK. Moreover, each lens had a tendency to rotate nasally or excyclorotate. This tendency is related to the symmetry or natural alignment of the superior lid. In fact, the normal blinking action of the lids causes the lens to rotate upward nasally. But with the use of the prism base, gravity forces the lens to assume an inferior position that ultimately provides better stability and greater predictability of prism base direction.

TABLE 1

Lens Parameters

Lens #	BC	Diameter	Power	Prism	CT
1	7.42	9.0	-3.00	1.5	27
2	7.50	9.0	-3.00	1.5	28
3	7.58	9.2	-3.00	1.5	28
4	7.67	9.2	-3.00	1.5	28
5	7.76	9.2	-3.00	1.5	30
6	7.85	9.2	-3.00	1.5	30
7	7.94	9.4	-3.00	1.5	30
8	8.04	9.4	-3.00	1.5	29
9	8.13	9.4	-3.00	1.5	30
10	8.23	9.6	-3.00	1.5	30

TABLE 2

Keratometry Readings

PT				
	1.	43.00 @ 037/ 43.00 @ 123	7.	42.75 @ 172/ 43.25 @ 082
		42.75 @ 180/ 43.00 @ 090		43.00 @ 172/ 45.00 @ 082
	2.	45.75 @ 162/ 47.00 @ 072	8.	43.00 @ 172/ 45.00 @ 082
		45.75 @ 162/ 46.00 @ 072		43.00 @ 172/ 45.00 @ 082
	3.	46.50 @ 180/ 45.00 @ 090	9.	44.12 @ 003/ 44.25 @ 093
		46.00 @ 180/ 45.50 @ 090		44.25 @ 003/ 44.75 @ 093
	4.	43.25 @ 147/ 43.75 @ 057	10.	42.50 @ 177/ 43.00 @ 087
		43.25 @ 178/ 44.00 @ 088		42.50 @ 177/ 43.00 @ 087
	5.	43.25 @ 177/ 43.50 @ 087	11.	42.25 @ 178/ 43.00 @ 088
		43.00 @ 150/ 43.25 @ 060		42.25 @ 178/ 43.00 @ 088
	6.	42.87 @ 177/ 42.75 @ 087	12.	44.50 @ 178/ 44.50 @ 088
		42.50 @ 177/ 43.00 @ 087		44.50 @ 178/ 44.50 @ 088

References

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