

FLEXURE AND RESIDUAL ASTIGMATISM OF
OPUS III LENSES ON TORIC CORNEAS

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ABSTRACT

The Opus III Rigid gas permeable (RGP) contact lens by Precision Cosmet was utilized to measure the effect of corneal toricity on the flexure and residual astigmatism of the new styrene based lens material. The study consisted of ten (10) eyes having both with and against the rule corneal toricities which averaged 2.12D. Each eye was fit with 3 lenses that were 0.50D steeper than 'k', or 'k', and 0.50D flatter than 'k'. The amount of flexure and residual astigmatism of each lens was then measured via keratometry and spherocylindrical overrefraction, respectively. The results indicate that the new styrene based lens material flexed approximately equal to values found for other RGP materials of the same parameters.

INTRODUCTION

The study of hard lens flexure and residual astigmatism began in 1961 with a paper by Neal Bailey. Since then a number of studies using the new RGP materials have been conducted (eg. Harris, 1970; Harris & Rodoya, 1982; Harris, 1982; Herman, 1983; Kochanny, 1984; Pole). The results of these studies indicate that rigid contact lenses flex on toric corneas, thus inducing residual astigmatism. The amount of flexure and residual astigmatism is dependent on the degree of corneal toricity, lens thickness, and the effective base curve to cornea fitting relationship. Pole found that lenses fit steeper than 'k' flexed significantly more than lenses fit on 'k' and flatter than 'k'. A comparative study done by Kochanny revealed that the three most popular RGP materials, Boston, polycon and silcon flexed approximately 0.25D/diopter of corneal toricity. The present study was designed to measure the flexure and residual astigmatism of the Opus III lens material. The Opus III is a new generation of styrene based gas permeable hard lenses. The lens is composed of tertiary butyl styrene copolymerized with four other monomers, including

silicon, to increase O_2 permeability. The D_k value of the new material is 14×10^{-11} @ 35°C with a wetting angle of 46 via the captive bubble technique.

METHODS

TABLE I

KERATOMETRIC DATA:

1.	47.12	@	180	;	46.12	@	090
2.	46.34	@	180	;	45.25	@	090
3.	43.00	@	175	;	46.00	@	085
4.	43.12	@	180	;	46.12	@	090
5.	41.75	@	165	;	43.25	@	075
6.	41.75	@	165	;	43.75	@	075
7.	41.62	@	010	;	44.12	@	100
8.	41.62	@	175	;	44.75	@	085
9.	41.87	@	180	;	43.75	@	090
10.	42.12	@	180	;	44.12	@	090

Ten eyes were used in the study with an average corneal toricity of 2.12D, ranging from 1 to 3 Diopters. Eight eyes showed with-the-rule (WTR) toricity and two eyes revealed against-the-rule (ATR) toricity. A series of three keratometry readings were taken and averaged to assess the degree of corneal toricity and to aid in the selection of the proper base curves. Each lens was hydrated and verified to insure sphericity and base curve specification.

The ten Opus III lenses used in the study were 9.5mm in diameter with an 8.0 mm optic zone and power of -3.00D. Base curves ranged from 7.34 to 8.12 mm in 0.08 mm steps. Center thickness ranged from 0.12 to 0.125 mm. Each eye was fit with three lenses having curves of 0.5D steeper than 'k', or k and 0.5D flatter than 'k'. The lenses were fit according to the flattest corneal meridian. Keratometry and spherocylindrical over-refraction were then performed over the lenses to measure lens flexure and residual astigmatism, respectively.

RESULTS

Figure 1 shows the effect that the base curve to cornea relationship has on flexure on the Opus III lens or toric corneas. Figure 2 shows the degree of residual astigmatism on both WTR and ATR toric corneas. The values for lens flexure and residual astigmatism were derived by dividing the total dioptric amount of flexure or residual astigmatism by the number of eyes.

When the lenses were fit 0.5D steeper than 'k' they flexed 69% of the total amount of corneal toricity. Lenses fit on 'k' flexed 29.1% and those fit 0.5D

flatter than k flexed 17.5%. From this, one can see that the results are comparable to those reported by other researchers. The overall average amount of lens flexure was 0.26D. The amount of residual astigmatism was significantly higher on ATR toric corneas than the values found for WTR toric corneas.

DISCUSSION

The data show that the average amount of lens flexure and residual astigmatism were approximately equal to those found for the other more commonly used RGP lens materials (Pole & Kochanny, 1981.). The results also indicate that RGP lenses flex less on ATR than on WTR toric corneas, thus inducing an increased amount of residual astigmatism. It's been found that flexure causes plus cylinder with the axis along the flatter principle meridian. An equal amount of minus cylinder with the axis along the flatter meridian is required to neutralize the cylinder. The additional amount of minus cylinder is referred to as induced residual astigmatism. On an ATR toric cornea induced residual astigmatism is minus cylinder axis 090. Therefore if the lens

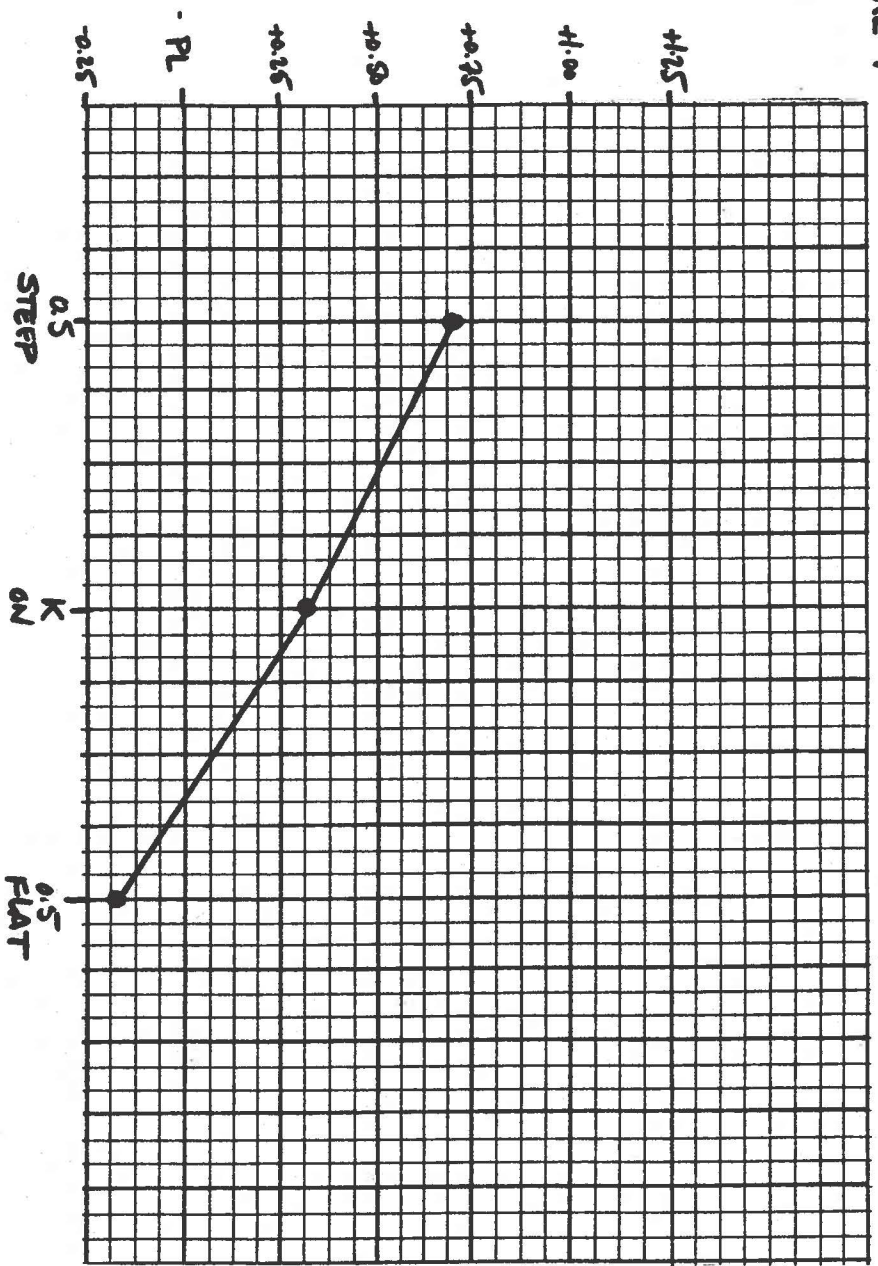
shows no flexure, the amount of residual astigmatism will be increased. On a WTR toric cornea induced residual astigmatism is minus cylinder axis 180. If the induced residual astigmatism is found to be 90° different than the calculated residual astigmatism, there will be a decrease in the amount of subjective residual astigmatism due to lens flexure.

CONCLUSION

The data indicate that the new styrene based lens material (Opus III) flexes approximately 0.26D/diopter of corneal toricity. A comparative analysis reveals that the lens flexes an amount equal to that of the three other more commonly used RGP materials, namely, Polycon, Boston and silcon of the same parameters.

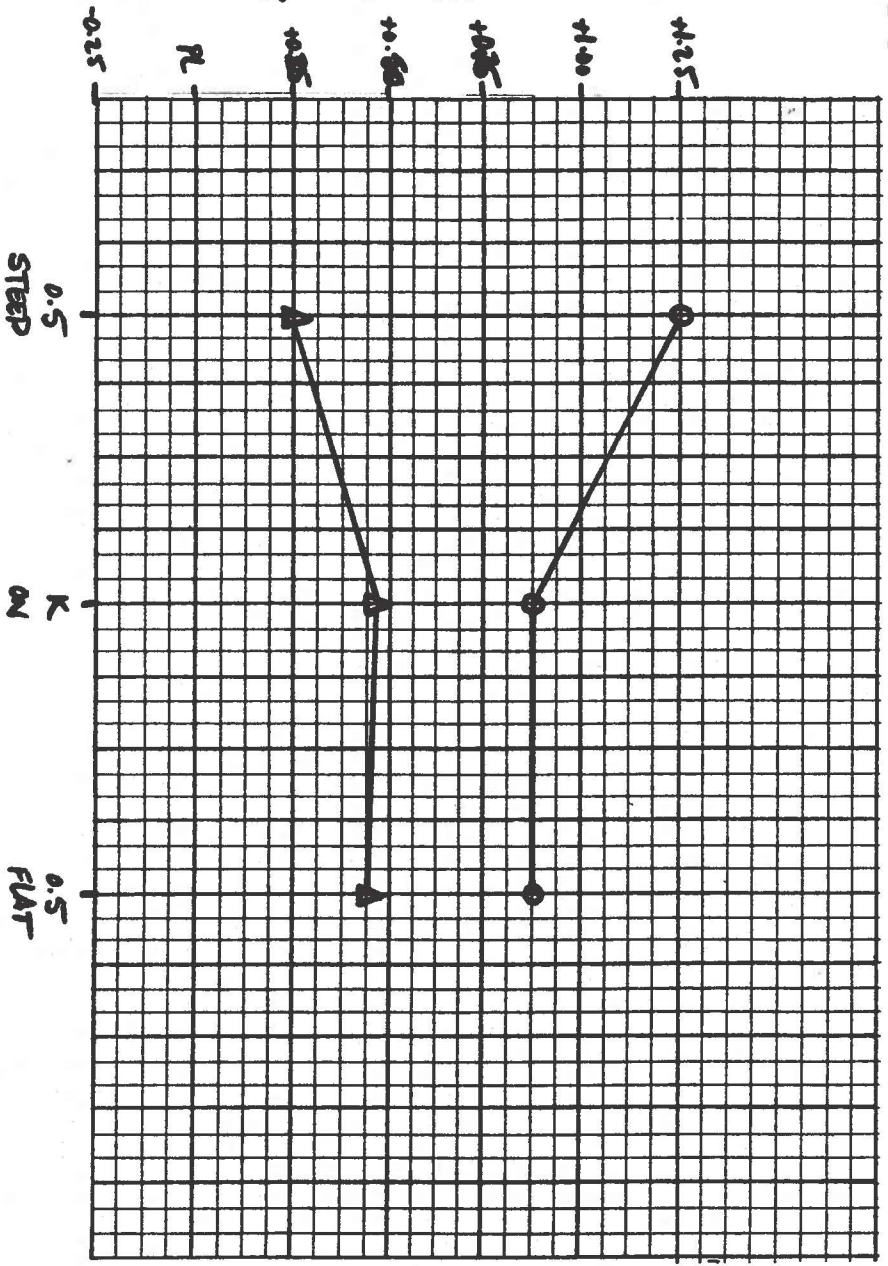
FLEXURE (DIOPTERS)/CORNEAL TORICITY

FIGURE 1



SIDUAL ASTIGMATISM / CORNEAL TORICITY
 Δ = WTR \circ = ATR

FIGURE 2



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