Senior Optometric Project

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Flexure Characteristics of the Wesley-Jessen AIRLens vs. Fitting Techniques.

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Abstrast

The Wesley-Jessen AIRLens is one of a new breed of gas-permeable contact lenses. It is a co-polymer of t-butyl styrene, has a specific gravity of 0.95 (it will float in water), a Dk of 25 X 10^{-11} at 35^{o}, a clinical ability to produce good visual acuities (95% better than 20/30), and because of the inherently strong structure of the lens----it is designed to correct up to 6 Diopters of corneal astigmatism. This last property of the lens is the topic we will investigate in this study, along with the investigation of which fitting technique is optimal for the minimization of flexure with the AIRLens. Eight subjects (15 eyes) having corneal toricity of 1.00 to 3.50 D. were used in this study. 13 eyes had with-the-rule astigmatism, while one subject (2 eyes) had against-the-rule astigmatism. Each eye was fit with 3 lenses--one lens was fit ON K, one lens was fit 0.50 D. flatter than K, and one lens was fit 0.50 D. steeper than K. Flexure (Over-K's) and residual astigmatism (Overrefraction) were measured for each lens in a masked fashion. The results indicate that 1) Corneal Toricity is not fully masked by the AIRLens and 2) The best fitting technique is using an AIRLens which is fit ON K.

Introduction

Studies involving lens flexure and residual astigmatism using PMMA and some gas permeable lenses are common in the literature. In the early 1960's, Bailey[1] noted that thin PMMA lenses flexed on toric corneas. Others, including Harris[2], felt that many factors were involved in lens flexure. These include lid pressure, adhesion, and surface tension of the lens on the eye. It was also felt that some of the parameters of the individual contact lens were involved in the flexure of the lens. The diameter, base curve, power, optic zone width, and center thickness all have been investigated for their contributions to lens flexure. It was found that the diameter and power did not influence the amount of flexure, although it was subsequently shown that an increase in minus power did increase thickness, which in turn decreases flexure. Harris and Chu[3] found that lenses fit flatter than K ride higher and show more ATR flexure than those lenses fit ON K or steeper than K, which show more WTR flexure. These findings apply to WTR corneas. Pole[4], in 1984, found that with Polycon lenses fit steeper than K, there was significantly more flexure than those fit ON K or flatter than K. It was also found by Harris[5], that PMMA lenses with a center thickness of less than 0.13 mm had a tendency to flex much more than those over 0.13 mm, and in 1985, DiMartino and Cupal[6] found that the ideal center thickness for a gas permeable lens (Paraperm O_2) is 0.17 mm. These studies followed more work by Harris[7], which showed that Polycon lenses of the same diameter as PMMA lenses, flexed significantly more on toric corneas. In general, we find the flexure is directly proportional to the corneal toricity.

With the advances made in the strength of materials in the contact lens field, it was felt a study of the new generation styrene type lenses, such as the AIRLens, should be undertaken. Claims have been made that these lenses can fully mask corneal astigmatism of relatively large amounts. This study, and a study done by Rautio[8] in 1986 on the Opus III styrene lens, were initiated to judge the manufactuers claims for accuracy and to get an idea of which fitting technique was best for these lenses.

Methods

There were 8 subjects (15 eyes) in this study. 5 subjects (10 eyes) were presently wearing contact lenses. Spectacle refractions revealed that 13 eyes had WTR astigmatism, while 2 eyes had ATR astigmatism which corresponded respectively to 13 WTR corneas and 2 ATR corneas. Keratometric and refractive status were measured before fitting the lenses. Table 1 summarizes the data for the patients involved in this study.

TABLE 1

	Mean	S.D.	Range
Corneal Toricity (Da)	1.91	0.76	1.0 to 3.25 D
Cylindrical Refractive Error (D)	1.80	0.52	1.0 to 3.0 D

The lenses used in this study were the Wesley-Jessen AIRLens having a 9.0 mm diameter, -3.00 D power, and a center thickness averaging 0.12 mm. Lenses were delivered from Wesley-Jessen and no modifications were made on the lenses. The only variable which was changeable was the base curve of the lenses.

After hydration, the base curve, power, diameter, and center thickness were measured to ensure accuracy. A statement about wettability should be made at this point. The lenses proved to be fairly inconsistent at wetting properly. We did not feel that this characteristic would influence our study of flexure and fitting technique, although at times the visual acuities were found to be slightly worse than expected.

The lenses were coded so that no bias existed from the examiner's point of view.

Keratometric readings provided the ON K fitting lens, and we then fit the next 2 lenses (one flatter, one steeper) approximately 0.50 D from the ON K fit. The original ON K fit was done with the flattest meridian being the one which was fit ON K.

The lenses were placed on each subject's eye in a random fashion. After settling down on the eye for 5 minutes, the flexure (Over-K's) and residual astigmatism (Overrefraction) were measured. Keratometric readings were taken 3 times and averaged to the nearest 0.12 D., while the residual astigmatism was calculated from a spherocylindrical refraction.

Results

Figure 1 compares the 3 commonly applied fitting techniques with the 3 average means of lens flexure, which were obtained by the averaging of 3 keratometric readings over the lens. We can see that the ON K fitting produced significantly less flexure (on the average) than either the steeper than K or the flatter than K fits.

Figure 1

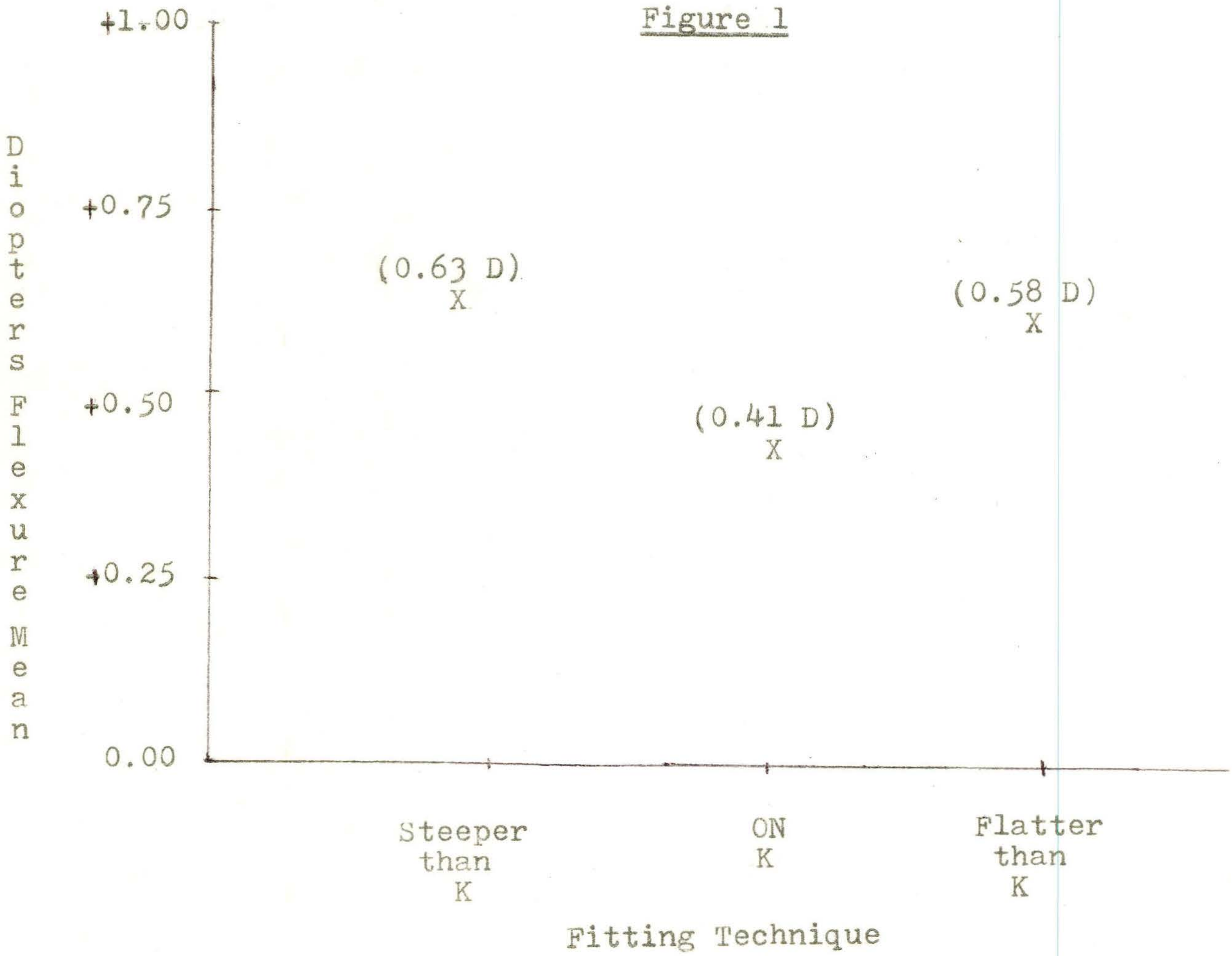
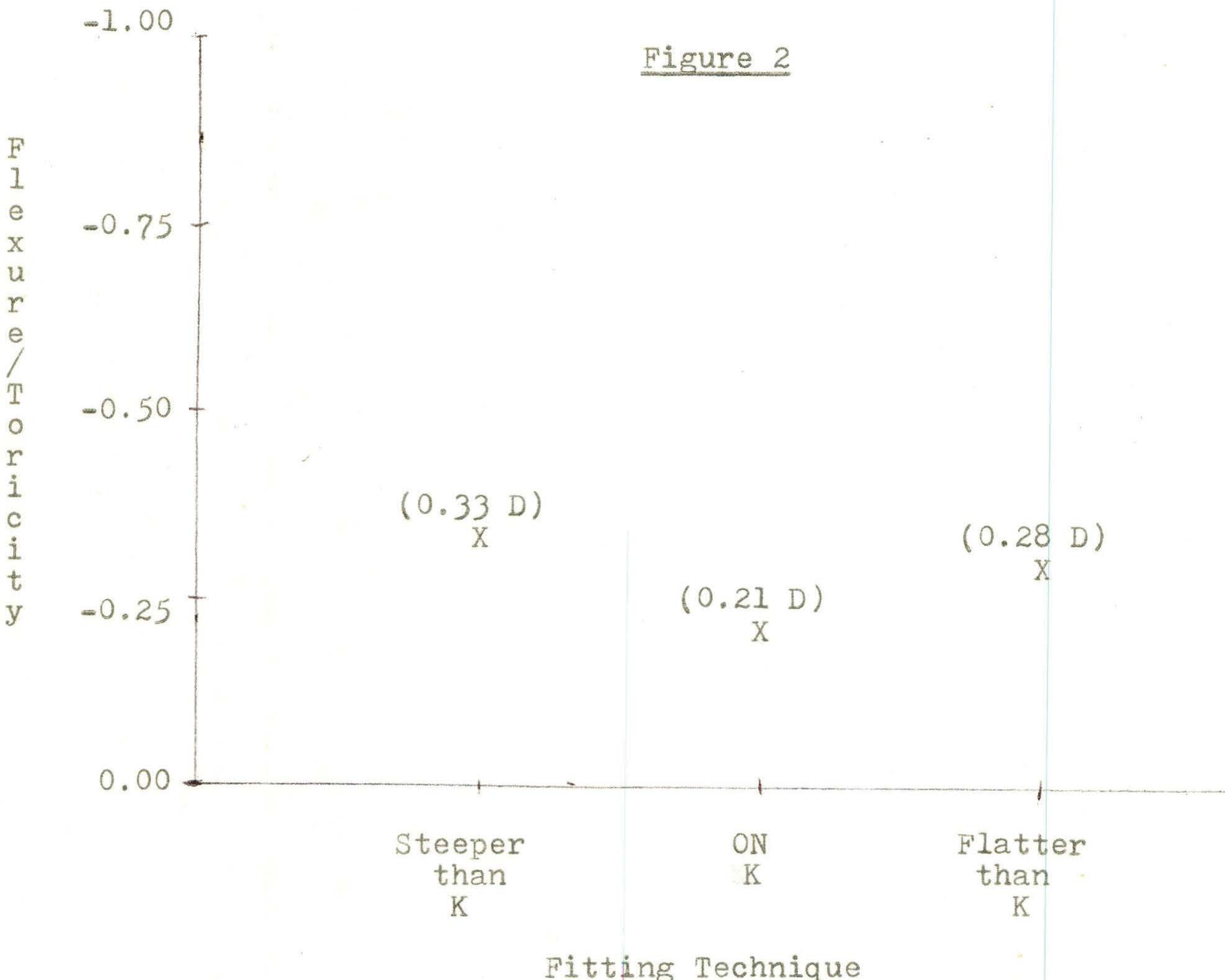


Figure 2 shows the average amount of flexure per unit corneal toricity with the 3 fitting techniques described above. The results revealed that the lenses fit ON K flexed 21.3% of the total corneal toricity. The flatter than K and steeper than K fits, flexed 27.8% and 33.3% respectively. For example, a lens fit ON K on a 3.00 D. toric cornea will show approximately 0.64 D. of flexure, while if fit flatter than or steeper than K, it will show about 0.83 D. and 1.00 D of flexure, respectively.

Figure 2



Discussion

The results of this study clearly indicate that all corneal astigmatism is not masked by the Wesley-Jessen AIRLens. It was also conclusively proven that the best fitting technique with this lens is an ON K fitting, as opposed to flatter than or steeper than K.

We know from previous studies [9] that the optic zone diameter and the center thickness of the lens[6], along with lid forces, play an important role in determining flexure. This study tends to follow others[4,5] in showing that, in general, ON K or flatter than K fits result in less flexure than steeper than K fits.

Clinically, this study will hopefully convince more contact lens fitters that there are some fits which are "better" than others. We realize that since flexure is determined by the center thickness, base curve to cornea fitting relationship, material used, size, and other individual characteristics of the eye---not all results reported here may be consistent 100 percent of the time.

References

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