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Predicting toric soft lens acuity by attenuated cylinder refraction

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Abstract

Purpose: As variability in vision with a toric soft contact lens is related to cylinder power, providing the lowest acceptable amount of cylinder correction is sometimes a useful strategy. It would be useful clinically to have a reliable method of testing the acceptability of reduced cylinder correction prior to actually selecting and placing a trial soft toric contact lens on the eye. It would be useful to determine a patient's potential acceptance of a cylinder power and axis that is adjusted to those available in the soft contact lens.

Method: 18 myopic subjects (29 eyes), with astigmatism between 0.50D and 1.75D were evaluated. After determining optimal manifest refraction, the cylinder component of the refraction was adjusted to comply with those available in a single use toric soft lens such that the cylinder values and axes in the phoropter were set at -0.75 axis 180 degrees for with-the-rule eyes and -0.75 axis 90 degrees for against-the-rule eyes. Sphere power was then adjusted to best subjective acuity. High and low contrast visual acuity was determined through this attenuated refraction. Focus Dailies Toric lenses with power corresponding to the attenuated refraction were applied and allowed to settle. High and low contrast acuity were determined again, and compared with acuity obtained with the attenuated refraction.

Results: Analysis showed a reasonably linear relationship between the visual acuities obtained from the adjusted refraction and the trial contact lens, with a trend to better acuity with the contact lens. Acuity with the contact lens was the same or better than the attenuated refraction for 93% of eyes.

Conclusion: Practitioners performing an attenuated cylinder refraction prior to selecting a soft toric contact lens should be able to reliably predict the patient's visual acuity with the contact lenses.

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Predicting Toric Soft Lens Acuity By Attenuated Cylinder Refraction

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Biographies

Ryan M. Fedor was born and raised in the community surrounding the town of St. Cloud, Minnesota. He attended the University of Wisconsin – Eau Claire, where he received his bachelor's degree in Biology in 2001. Currently, Ryan attends Pacific University College of Optometry where he is in his fourth year of studies. He enjoys numerous outdoor activities, but is especially fond of fishing and hunting. Upon graduation in May 2005, he plans on moving back to Minnesota to practice optometry.

Douglas J. Pethe was born and raised in Littleton, Colorado. He attended Colorado State University in Fort Collins, Colorado where he received his bachelor's degree in Biological Science with a minor in Anatomy and Neuro-physiology in 2000. Doug is currently a fourth year optometric student at Pacific University College of Optometry. Doug has been happily married for two years to his wife Amber who is an Occupational Therapist. In his free time, Doug enjoys skiing, golfing and most outdoor activities. Upon graduation in May of 2005, Doug and Amber plan to move back to Colorado where Doug will begin his Optometric career.

Abstract:

Purpose: As variability in vision with a toric soft contact lens is related to cylinder power, providing the lowest acceptable amount of cylinder correction is sometimes a useful strategy. It would be useful clinically to have a reliable method of testing the acceptability of reduced cylinder correction prior to actually selecting and placing a trial soft toric contact lens on the eye. It would be useful to determine a patient's potential acceptance of a cylinder power and axis that is adjusted to those available in the soft contact lens. **Method:** 18 myopic subjects (29 eyes), with astigmatism between 0.50D and 1.75D were evaluated. After determining optimal manifest refraction, the cylinder component of the refraction was adjusted to comply with those available in a single use toric soft lens such that the cylinder values and axes in the phoropter were set at –0.75 axis 180 degrees for with-the-rule eyes and –0.75 axis 90 degrees for against-the-rule eyes. Sphere power was then adjusted to best subjective acuity. High and low contrast visual acuity was determined through this attenuated refraction. Focus Dailies Toric lenses with power corresponding to the attenuated refraction were applied and allowed to settle. High and low contrast acuity were determined again, and compared with acuity obtained with the attenuated refraction. **Results:** Analysis showed a reasonably linear relationship between the visual acuities obtained from the adjusted refraction and the trial contact lens, with a trend to better acuity with the contact lens. Acuity with the contact lens was the same or better than the attenuated refraction for 93% of eyes. **Conclusion:** Practitioners performing an attenuated cylinder refraction prior to selecting a soft toric contact lens should be able to reliably predict the patient's visual acuity with the contact lenses.

It has been estimated that 30% of the population with ametropia have 0.75 D or more refractive astigmatism and that 45% of persons who want to wear soft contact lenses have an astigmatism of 0.75 D or more (Scheid[1], 2002). The options for astigmatic soft contact lens correction remains relatively limited. In fitting soft lenses, optimal results often are obtained with the least amount of cylinder acceptable to the patient, rather than the full correction. This is due to fact that the negative impact of lens rotation is directly proportional to the magnitude of cylinder correction (Bergenske[2], 2003). With the increasing popularity of daily disposable contact lenses, CIBA Vision was the first to release a daily disposable soft toric contact lens. This particular lens is available in just 46 variations (Plano to –6,00)with one cylinder value of -0.75D at either 90 degrees or 180 degrees. Our clinical study was aimed to determine if there is a reliable method of testing the acceptability of reduced cylinder correction prior to actually selecting and placing a trial lens on the eye. In addition to the question of cylinder power, it would be useful to determine a patient's potential acceptance of a cylinder axis that is adjusted to the axis available in the soft contact lens.

Methods:

We conducted a clinical study that included 18 myopic people, with a total of 29 tested eyes (-0.50D to –6.00D) with astigmatism between 0.50D and 1.75D. The subject population all had received a complete visual examination within the 12 months prior to our clinical testing. Each subject's existing prescription was set in the phoropter and a monocular sphere to best visual acuity combined with Jackson cross cylinder was

assessed and refined to assure an accurate starting refraction. These values were recorded and the acuity was measured with a projected Snellen chart set up for a 20 foot exam lane distance. We used the CIBA Focus Dailies Toric soft contact lenses (CIBA Vision Corporation; Duluth, Georgia) as the trial lenses for our clinical study. The Focus Daily Toric contact lenses are available in one cylinder power of -0.75D at axis 90 degrees or 180 degrees. As we were limiting contact lens fitting to the only one power available, the subject's optimal cylinder values had to be adjusted to meet the specifications of the available contact lenses. The cylinder values and axes in the phoropter were set accordingly at –0.75 axis 180 degrees for with-the-rule eyes (axis 30 to 150), and –0.75 axis 90 degrees for against-the-rule eyes (axis 60 to 120). For eyes that had cylinder outside of these ranges we set the cylinder to which ever was the closest axis, 90 degrees or 180 degrees. With the cylinder now adjusted to values that are available in the trial contact lenses, we proceeded to adjust the spherical component by performing a monocular sphere to best visual acuity for each eye.Once the best acuity was achieved with the optimized reduced cylinder refraction, the patient's monocular visual acuities were measured with Bailey-Lovie high contrast and low contrast charts. Each subject was then fitted with a pair of Focus Daily Torics of the same power found in the optimized reduced cylinder refraction, with correction for vertex if indicated. Each patient was required to wait 10 minutes after the contact lenses were put in to allow the eyes and lenses to equilibrate. We used the same Bailey-Lovie high contrast and low contrast charts to measure monocular visual acuities with the contact lenses. This data was all obtained from each subject in the same 12 foot examination lane, with the same equipment, under the same illumination.

Results:

The relationship of acuity with the adjusted refraction and acuity with the contact lens is quite linear, as can bee seen in *figures 1* and *2*. Pearson's correlation coefficient is used. For low contrast letters, the regression slope is 0.7389 (95% confidence interval 0.4748 to 1.0029). P< 0.0001, r=0.7413. Mean difference between the two conditions was +2.17 letters additional read with the contact lens (range –6 to +12). For high contrast letters, the regression slope is 0.8073 (95% confidence interval 0.5473 to 1.0067). P< 0.0001, r=0.7753. Mean difference between the two conditions was +2.00 letters additional read with the contact lens (range –3 to +7). Many eyes showed better visual acuity with the Focus Dailies Toric contact lenses than with the adjusted refraction . For the low contrast letters, 65.52% of the subject eyes had better acuity (at least two letters) with the contact lens than the adjusted refraction. For the high contrast letters, 58.62% of the subject's eyes had better acuity (at least two letters) with the contact lens than the adjusted refraction. 41.38% of the subject's eyes had better high and low contrast acuity (at least two letters) with the contact lens than the adjusted refraction. Only 6.89% of the sample eyes had better high and low contrast acuity (at least two or more letters) with the adjusted refraction than with the contact lenses. Thus, acuity with the contact lens was the same or better than the attenuated refraction for 93% of eyes.

Discussion:

Our clinical study showed a close relationship between the visual acuities obtained from the adjusted refraction and the trial contact lens. Predicting toric soft contact lens acuity

by performing an attenuated cylinder refraction could be useful to practitioners. This procedure can save valuable time when selecting a trial lens from various combinations of spherical and cylindrical powers. Since lens rotational effects increase directly with cylindrical power, patients with higher astigmatic refractive error can likely be fit comfortably into a soft toric contact lens that has less cylinderl correction than their full refractive error indicates. Unfortunately, the daily toric lenses used in our study do not have markings to indicate rotation, thus any rotation effects of the lenses could not be noted and accounted for. It is possible that many of the lenses underwent a rotation which placed the cylinder correction closer to the ideal cylinder axis, rather than staying at 90 or 180. This may explain in part the reason that many eyes had better acuity with the contact lenses than with the adjusted refraction. Another possible reason for the improved acuity with the contact lenses may be due to the lenses having greater cylinder power than labeled.

All of the subjects were optometry students who may be more familiar with the visual acuity procedures than the general public and this may have influenced results somewhat Another limitation to our study was the limited contact lens wear time to which this sample population was subjected. Perhaps multiple acuity measurements taken at select times for complete daily wearing schedule could provide a more specific correlation. Further studies with multiple brands of soft toric contact lenses would be beneficial to provide optometric practitioners with more information on which contact lenses would best be suited for various patient presentations.

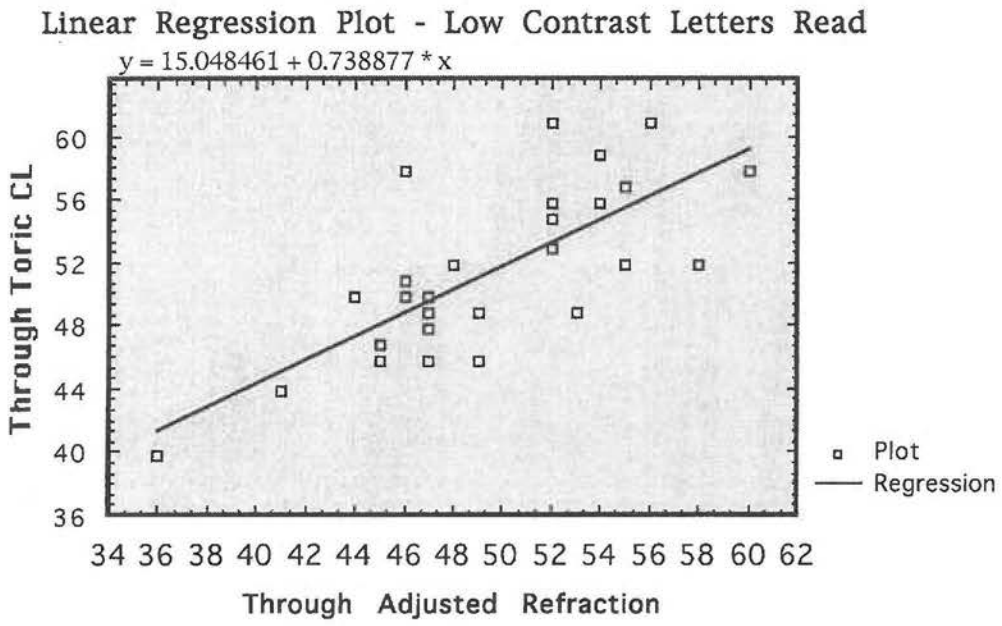

Figure 1: **Regression line and scatter plot relating low contrast letters read with the adjusted refraction and with the toric contact lenses**

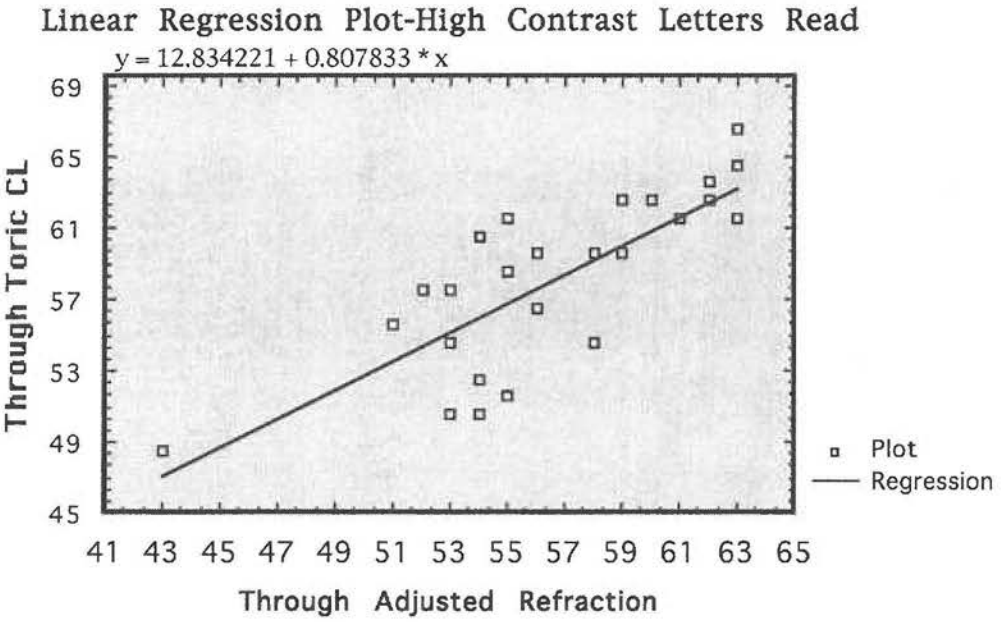

Figure 2: **Regression line and scatter plot relating high contrast letters read with the adjusted refraction and with the toric contact lenses**

References:

1. Scheid, Terry R. Clinical Manual of Specialized Contact Lens Prescribing. 2002; 41-48.

2. Bergenske, Peter D. "Correcting Astigmatism: More or Less?" Contact Lens Spectrum. June 2003; 19.