The Effect of Wesley-Jessen *Wild Eyes* Contact Lenses on Visual Function

1999 Senior Research Project
Troy Rhodes
Marla Schluentz

Abstract

Purpose: To determine if *Wild Eyes®* soft contact lenses reduce or improve visual function under photopic and/or mesopic conditions in a statistically or clinically significant way, compared to the D_3LT soft contact lens from the same manufacturer. The D_3LT data was deemed the gold standard for comparison as this is virtually the same soft contact lens without special effects. A brief exit survey was used to gather subjective data concerning relative comfort, vision, value, intended wear schedules and the potential for sharing lenses with friends.

Methods: Nineteen subjects were fitted with *Wild Eyes®* lenses. Visual performance was measured in the following areas: contrast sensitivity, psychometric visual acuity, Bailey-Lovie logMAR visual acuity, contrast sensitivity recovery times following a headlight simulation, and visual field extent using arc perimetry. The subjects were also fitted with D_3LT lenses and performed the same tests. The order in which the lenses were fitted was randomized. Testing was performed under both photopic and mesopic conditions.

Results: Compared to data for the D_3LT lenses, contrast sensitivity of subjects wearing *Wild Eyes®* lenses under mesopic conditions was reduced by a statistically significant amount ($r = .402$, $p = .012$). Psychometric visual acuities were reduced. Mesopic acuities were reduced more than photopic acuities and monocular acuities were reduced more than binocular acuities. However, none of the reductions in psychometric visual acuities were statistically or clinically significant.

Bailey-Lovie logMAR monocular visual acuities with *Wild Eyes®* lenses were reduced by 3.06% under photopic conditions and 4.46% under mesopic conditions. Again, monocular acuities were generally reduced more than binocular acuities. The logMAR acuity reductions were statistically significant (photopic: $r = .507$, $p = .01$. mesopic: $r = .487$, $p = .02$.) with borderline clinical significance. On the exit survey, 14 out of 19 subjects acknowledged that the D3LT lenses provided better vision, which lends support to the possibility of clinical significance.

Contrast sensitivity recovery times were longer with *Wild Eyes®* lenses, but the increase was neither statistically nor clinically significant.

Threshold peripheral fields were reduced by an average of 10.6 degrees temporally and 2.3 degrees nasally. If the temporal restrictions were analyzed in the 180 meridian exclusively, there was an average monocular loss of 12.0 degrees or an average binocular loss of 24 degrees temporally. The average reductions were statistically significant, both temporally and nasally (temporally, $r = .595$, $p < .001$, nasally, $r = .538$, $p = .01$.) Clinically, only the temporal reductions carry much significance.

The exit survey results suggested that subjectively, the *Wild Eyes*:

1. were relatively less comfortable than the D_3LT lenses.
2. provided less sharp vision than the D_3LT lenses.
3. would be worn primarily for special occasions.
4. may occasionally be loaned to friends.

5. produce haziness or blur in peripheral vision far more often than D_3LT lenses.
6. produce more variability in the vision than the D_3LT lenses.

Conclusions: The most significant change in visual performance using *Wild Eyes* compared to D3LT lenses was a temporal field reduction of approximately 24 degrees in the horizontal meridian. There were measurable and significant reductions in contrast sensitivity. Recovery of contrast sensitivity after glare exposure in a headlight simulation did not take significantly longer for subjects wearing *Wild Eyes*® lenses. There were modest reductions in visual acuity, measured both by Bailey-Lovie logMAR charts and psychometric charts, although only the Bailey-Lovie visual acuities were statistically significant. Overall, the *Wild Eyes*® lenses caused enough measurable and significant reductions in visual performance, that it is incumbent on the clinician to educate patients about the potential reductions prior to the patients performing any visually demanding tasks such as driving.

Introduction

Contact lenses are worn for a variety of purposes. Cosmetic changes are a common motivating factor in lens purchase and lens wear. The *Wild Eyes*® lenses produced and marketed by Wesley-Jessen play a significant role in that market. Wesley-Jessen provided all the contact lenses used in the study.

The purpose of the study was to determine what effects, either positive or negative, that *Wild Eyes*® lenses have on visual function. Previous studies on the effects of soft contact lenses with an opaque or translucent annulus have produced mixed results.[1,2,3,4,5] The D_3LT lenses, also manufactured by Wesley-Jessen, were used as the basis for comparison since it is essentially the same lens without cosmetic effects. All reported changes in visual performance use D_3LT lens data as the baseline number for comparison.

Methodology

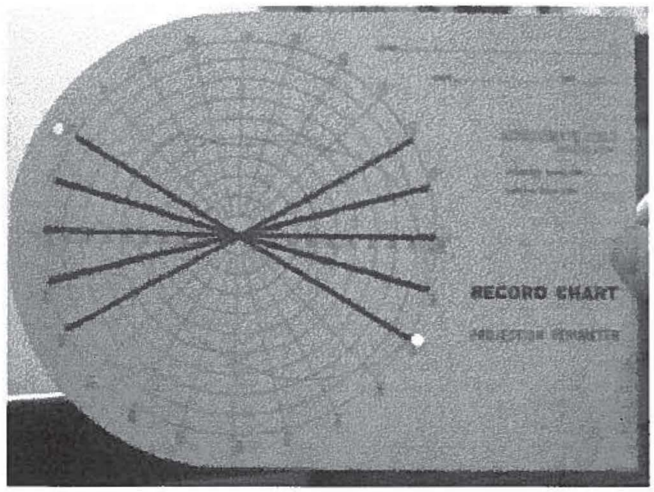
Subjects were excluded from the cohort if they fail to meet the following criteria:

1. ≤ 0.75 diopters of residual astigmatism while wearing soft contact lenses
2. age between 16 and 29 years inclusive
3. 20/20 or better Snellen visual acuity OD, OS and OU using conventional soft contact lenses
4. refractive status between +0.50 and –3.00 diopters
5. previous soft contact lens wearer
6. adequate fit using 8.6 base curve
7. free from ocular disease

All subjects had the study procedures explained to them, and signed a consent form. Adequate centration, movement, and limbal coverage were achieved on all subjects. Both types of Wesley-Jessen lenses had overall diameters of 14.5 mm with base curves of 8.6 mm. The *Wild Eyes*® lenses had pupil diameters of approximately 5 mm. Published Dk/L values for the two lenses were identical at 16.1. The order in which the lenses were worn was randomized to prevent serial contamination from learning effects.

Prior to testing, the lenses were worn for approximately eight hours. Once the subject was present in the exam room, all doors and light tight window curtains were closed to better control light levels. Subjects were allowed to adapt to photopic lighting conditions of 10 footcandles for five minutes before any testing began.

Visual field testing OD and OS was performed first using a Bausch & Lomb arc perimeter. The arc perimeter was chosen because of its ability to test much further into the periphery compared to an automated perimeter such as the Humphrey visual field analyzer. A 6mm white stimulus was used. The stimulus was moved from non-seeing to seeing with the target moving at a rate of approximately two centimeters per second. The peripheral field was determined in the 180 meridian, and at 15 and 30 degrees above and below, temporal and nasal, for a total of ten points tested for each eye. The results were recorded on punch charts and scored by interpolation to the nearest degree. The photograph shows a typical recording sheet with the tested meridians highlighted.



Contrast sensitivity OD, OS and OU was determined using a Robison-Pelli contrast sensitivity chart at 20'. Guessing was encouraged and subjects were given 15 seconds to guess the next letter if needed.

Visual acuities OD, OS and OU were assessed using a Bailey-Lovie logMAR chart at 20' and psychometric visual acuity cards with tumbling E optotypes at the appropriate 10' test distance.

The incandescent lighting was then reduced to mesopic levels of 2 foot-candles. Subjects were allowed to dark adapt for ten minutes before re-testing contrast sensitivity, psychometric visual acuity and Bailey-Lovie logMAR visual acuity.

Then, after approximately 20 minutes of adaptation to the mesopic conditions, the headlight simulation was performed. The effects of headlight glare on contrast sensitivity were determined by subjecting the patient to 11 seconds of glare from a commercially available glare tester incorporating two actual sealed beam headlights. The timer was set to produce 11 seconds of glare, which was directed toward the patient's face. During this period, the subject was directed to fixate a target four feet to the right of the glare source. The glare source was 20' away from the subject.

After the glare source was removed, the subject's attention was directed to the last complete triplet that the subject could read easily under mesopic testing with the Pelli-Robison contrast sensitivity chart. Recovery was indicated when the subject successfully read the designated triplet without error. If an error was made, the subject was encouraged to read the triplet again until the triplet was read correctly.

A brief exit survey was given regarding relative comfort of the two lens types, *Wild Eyes®* lenses comfort, subjective comparison of vision quality, intended wear schedule, possibility of sharing of the special effects lenses, perceived additional value of the special effects lenses, haziness or blur of side vision and variability of vision.

Results

A comparison of the *Wild Eyes®* data to D_3LT data reveals a significant reduction in peripheral fields. All 19 subjects except one experienced a temporal field reduction in both eyes with *Wild Eyes®* lenses. Nasal field changes were less consistent, probably due to the greater field restriction of the facial structures themselves, or perhaps due to nasal decentration.

Temp. Avg	-10.6
Std. Dev.	4.0

Nas. Avg	-2.3
Std. Dev.	3.99

If the horizontal meridian is considered by itself, a somewhat greater restriction was apparent.

	180 meridian
Avg	-11.34
Std. Dev.	6.21

Contrast sensitivity results were computed in three ways under both photopic and mesopic conditions. The photopic results are reported first. First, the percent change in cycles per degree was computed. The standard deviation for these figures is very high since the range of possible responses is very high.

photopic % Change as computed in cycles per degree

	OD	**OS**	**OU**
Avg	-2.27	-10.14	-6.06
S Dev	63.41	57.27	33.41

mesopic % Change as computed

	in cycles per degree		
	OD	**OS**	**OU**
Avg	-23.83	-23.23	-23.42
S Dev	27.08	22.94	27.17

Second, the change in log units was computed. Note that this is not a percentage change and the standard deviation is compressed by the log scaling.

	photopic	Change as computed in log units	
	OD	**OS**	**OU**
Avg	-0.08	-0.12	-0.05
S Dev	0.24	0.24	0.15

	mesopic	Change as computed in log units	
	OD	**OS**	**OU**
Avg	-0.14	-0.13	-0.14
S Dev	0.16	0.14	0.17

Lastly, the average number of letters lost relative to the D_3LT lenses data was computed.

	photopic	Number of Letters Lost or Gained	
	OD	**OS**	**OU**
Avg	-1.58	-2.32	-1.05
S Dev	4.89	4.88	3.06

	mesopic	Number of Letters Lost or Gained	
	OD	**OS**	**OU**
Avg	-2.89	-2.68	-2.89
S Dev	3.20	2.71	3.40

Under photopic conditions, the following psychometric visual acuity results (reported in VAR units) were obtained:

	D3LT			WE				% Change		
photopic	**OD**	**OS**	**OU**	**OD**	**OS**	**OU**		**OD**	**OS**	**OU**
Avg	97.87	97.36	98.77	96.83	96.53	98.38	**Avg**	-1.04	-0.82	-0.37
Std Dev	1.98	2.27	1.52	2.44	2.41	1.54	**Std Dev**	2.79	2.72	1.76

Under mesopic conditions, the following results (reported in VAR units) were obtained:

	D3LT			WE				% Change		
meosopic	**OD**	**OS**	**OU**	**OD**	**OS**	**OU**		**OD**	**OS**	**OU**
Avg	90.02	89.94	92.91	88.35	89.14	91.03	**Avg**	-1.84	-0.81	-1.97
Std Dev	3.05	3.20	2.48	4.24	4.12	3.13	**Std Dev**	3.91	5.00	3.82

The Bailey-Lovie logMAR visual acuities obtained under photopic conditions are summarized below:

Photopic logMAR	% change OD	% change OS	% change OU
Avg	-2.98	-3.14	-1.90
Std Dev	4.12	3.75	3.16

The Bailey-Lovie logMAR visual acuities obtained under mesopic conditions are summarized below:

Mesopic logMAR	% change OD	% change OS	% change OU
Avg	-4.71	-4.02	-4.16
Std Dev	5.43	5.39	3.74

Under photopic monocular conditions, Psychometric and Bailey-Lovie VA's were reduced about 1% and 3% respectively using *Wild Eyes*® lenses. Under photopic binocular conditions, VA's were reduced about .4% and 2% respectively.

Under mesopic monocular conditions, Psychometric and Bailey-Lovie VA's with *Wild Eyes*® lenses were reduced about 1% and 4.3% respectively. Binocularly, VA's were reduced by 2% and 4% respectively. Interestingly, under mesopic conditions, the percent drop in VA (when switching from D3LT lenses to *Wild Eyes* lenses) was greater binocularly than monocularly, though not by much.

Changes in the contrast sensitivity recovery times for the two different lenses on average, were as follows:

Seven out of nineteen subjects had moderately faster responses while wearing *Wild Eyes*® lenses. Most of the remaining subjects had modestly slower responses, but a few had dramatically slower scores wearing *Wild Eyes*® lenses.

Headlight Simulation Recovery Times

	D3LT	WE	Difference
1	3.5	3.0	-0.50
2	3.0	2.5	-0.50

3	7.8	8.0	0.20
4	4.0	6.0	2.00
5	7.5	4.0	-3.50
6	2.0	6.0	4.00
7	10.0	4.0	-6.00
8	5.0	6.0	1.00
9	3.0	19.0	16.00
10	3.0	4.0	1.00
11	3.0	4.5	1.50
12	5.5	12.0	6.50
13	4.0	4.0	0.00
14	4.0	12.0	8.00
15	3.5	6.0	2.50
16	5.6	3.7	-1.90
17	10.5	3.5	-7.00
18	5.0	16.0	11.00
19	5.0	4.0	-1.00
Avg	4.99	6.75	1.75
Std Dev	2.39	4.65	5.57

*Note that a negative score indicates a *faster* response while wearing *Wild Eyes* lenses.

Please note that appendix 1 contains several graphs of the previous numerical data.

The results of the exit survey are summarized as follows:

An eight question exit survey was administered to each participant. The number of participants who circled a particular answer is shown first, while the percent of participants (to the nearest percent) who circled a particular answer is shown in parentheses. Question five required the participants to circle all answers that applied while all other questions required a single response. Therefore, the percentage of participants adds up to greater than 100% in question five.

1. After trying both lenses, I thought that:
   a. The *Wild Eyes*® lenses were more comfortable. 0 (0%)
   b. The D_3LT light tint lenses were more comfortable. 15 (79%)
   c. Comfort was about the same with both types of lenses. 4 (21%)

2. On a scale of one to ten, with one being extremely comfortable and ten being extremely uncomfortable, I thought that the *Wild Eyes*® lenses were:
   1. ☺ Extremely comfortable 1 (5%)
   2. 1 (5%)
   3. 2 (11%)
   4. 2 (11%)
   5. 2 (11%)
   6. 1 (5%)

7. 2 (11%)
8. 2 (11%)
9. 4 (21%)
10. ☹ Extremely uncomfortable 2 (11%)

3. In terms of vision quality, I thought that:
   a. The D3LT light tint lenses provided better vision. 14 (74%)
   b. The *Wild Eyes*® lenses provided better vision. 0 (0%)
   d. I couldn't really tell any difference in the quality of vision between the two types of lenses. 5 (26%)

4. I would be willing to pay $______ for a pair of *Wild Eyes*® lenses.
   a. $00 8 (42%)
   b. $50 6 (32%)
   c. $100 4 (21%)
   d. $150 1 (5%)
   e. $200 0 (0%)
   f. $250 0 (0%)
   g. more than $250 0 (0%)

5. If I bought a pair of *Wild Eyes*® lenses, I would probably wear them: **(please circle all that apply)**
   a. a few times a year. 4 (21%)
   b. for special occasions like birthdays, costume parties or Halloween. 15 (79%)
   c. once a month 1 (5%)
   d. once a week. 2 (11%)
   e. usually on weekends 3 (16%)
   f. two or three times per week. 3 (16%)
   g. almost every day 0 (0%)
   h. I'm not sure how often I would wear them. 0 (0%)

6. I would let a friend try out my *Wild Eyes*® lenses under the following circumstances:
   a. Not under any circumstances. 17 (89%)
   b. Only if we cleaned and disinfected them before the friend tried them on, and again before I got them back. I would have to be there to make sure they did everything right. 1 (5%)
   c. So long as we cleaned and disinfected them before the friend tried them on and before I got them back. 1 (5%)
   d. Sure, anytime.

7. As far as my side vision (peripheral vision) is concerned:

a. I thought the *Wild Eyes*® lenses and D3LT light tint lenses were about the same. They both gave normal side vision. 1 (5%)
b. I thought the *Wild Eyes*® lenses and D3LT light tint lenses were about the same. Occasionally, they both made things a little fuzzy or hazy off to the side of my vision. 0 (0%)
c. I thought the *Wild Eyes*® lenses occasionally made things a little fuzzy or hazy off to the side of my vision. 18 (95%)
d. I thought the D3LT light tint lenses occasionally made things a little fuzzy or hazy off to the side of my vision. 0 (0%)

8. I thought that the:
   a. D3LT light tint lenses gave somewhat variable vision. 0 (0%)
   b. *Wild Eyes*® lenses gave somewhat variable vision. 10 (53%)
   c. both lenses gave somewhat variable vision. 4 (21%)
   d. neither lens type gave variable vision. 5 (26%)

Discussion

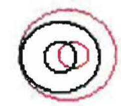
The ability to see well is critical for numerous tasks. However, some tasks such as driving, also involve significant risk to the driver and to others. Because of this, certain minimum standards concerning visual acuity and visual fields have been enacted into law. If a clinician prescribes a visual correction that compromises the patient's visual performance, particularly in one of these well-defined areas, certain ethical, moral and legal responsibilities come into play. Furthermore, even if the patient's visual performance exceeds the legal minimum standards but is not optimal, there is at least the obligation to inform the patient of these potential reductions.

Statistically significant reductions in visual performance were noted in peripheral fields, visual acuity and contrast sensitivity. In terms of clinical significance, the reductions in field are the most important. But even though the other reductions were modest in and of themselves from a clinical point of view, in combination there may be a negative synergistic effect similar to that described in the PDR for Ophthalmology under evaluation of permanent visual impairment.[6]

The photopic and mesopic light levels chosen were somewhat lower than would be indicated for "ideal" testing of contrast sensitivity and visual acuities using standard methods. However, it was felt that the artificial pupil of the *Wild Eyes*® lenses would have maximum effects, positive or negative, under these conditions.

Under these conditions, the artificial pupil would be relatively smaller than the true pupil, and of course located more anteriorly. In this position it acts as a field stop and may have at least 4 effects. It may reduce field of view, it may change the net shape of the pupil to a more oval or slit-like opening (illustration 1) if the lens decenters, it may reduce the amount of entering light and it may cause some additional diffraction effects.

illustration 1



iris/pupil

W.E/artificial pupil

In Michigan, the law requires 110 degree field of view, which is determined by adding the two monocular temporal fields together. All of the subjects in this study could easily pass those requirements, but the clinician would still be well advised to warn the patient about a possible reduction in field.

Some studies[7] used automated static perimetry in determining the effect on peripheral fields. In some cases this did not test any further peripherally than 60 degrees, which does not extend far enough to rule out any restriction. Manual dynamic perimetry using an arc perimeter allows testing well into the periphery to better detect field restrictions.

The field reductions were most apparent in the horizontal meridian temporally. The field reduction is a result of the artificial pupil acting as a field stop. Logically, one assumes that if the lens decenters nasally, that will produce an even greater reduction in temporal field. It would be interesting to confirm or deny the correlation by quantifying decentration immediately before, during or after the fields were done.

Subjectively, the participants almost universally noted some blur in the periphery, which may relate to the intermittent or constant reduction in field as the lens decenters nasally.

However, it should be noted that there are many other factors that affect peripheral vision while driving, especially in low light conditions. Consider just three examples. First, the A-pillars, which form the lateral parts of the windshield frame, cause a significant restriction. Second, the presence of a passenger causes a significant blind spot or “absolute scotoma” to the right of the driver. Third, during conditions when the driver must depend primarily on headlights for illumination, those areas outside the headlight beams represent large and deep field restrictions for objects such as deer. Other automobiles, with their own source of illumination, overcome this restriction.

Contrast sensitivity under mesopic conditions was reduced by a clinically significant amount ($r = .402$, $p = .012$). However, under photopic conditions, the results were dramatically different with no similar loss ($r = .01$, $p = .951$.) It is speculated that the reduction is due primarily to reduced light entering the eye, but further study is called for to better understand the etiology under mesopic conditions.

Psychometric visual acuity measurements produced problematic results. To score a psychometric VA test, one plots the data on a score sheet to get a typical psychometric shaped function, with VA read off the Y-axis at the 50% correct response level of a "best fit" curve.

Under photopic test conditions, the subjects never reached a 50% error level, while the mesopic test generated data with (predominantly) abrupt drop-offs in VA, such that a "best fit" curve was difficult to plot. To salvage the data, it was scored in traditional Snellen fashion, but corrected for guessing. For all lines below 50% correct (since a perfect 8/8 would imply little or no guessing) one letter was subtracted, eg 20/45 +4 translates to 20/45+3. 20/38 +3 translates to

20/38 +2. And 20/38+1 was simply thrown out and reverted to the score of the previous larger line.

Psychometric visual acuities were not reduced by a statistically significant amount. This data appeared less reliable and did not reveal anything not already revealed by logMAR visual acuity testing. To improve the resolution of the psychometric visual acuity testing under similar circumstances in the future, it may be worthwhile to increase the test distance during photopic testing.

During the headlight simulation, CS recovery times were not statistically significantly longer with *Wild Eyes*. However, for reasons that are unclear, five subjects had recovery times that were much longer (4 to 19 additional seconds) while wearing *Wild Eyes* lenses. Only one subject had a recovery time that was more than four seconds longer while wearing the D3LT lenses. There is little published information regarding contrast sensitivity recovery times following exposure to glare, though this may provide more valuable information that recovery of high contrast visual acuity. Low and moderate frequency contrast sensitivity may be a better indicator of driving performance.

The subjective exit survey further reinforces the objective data concerning the reduction in peripheral fields and overall visual performance reductions in acuity and contrast sensitivity. It is also interesting to note that ten percent of the subjects were willing to share lenses with a friend under some circumstances. Considering that most of the responses to the survey question strongly imply that there could be risks associated with sharing, 2/19 probably under reports the number of patients willing to share their lenses.

Further study concerning decentration and peripheral field loss may be warranted. Further study may also give insight into the significant difference in contrast sensitivity performance in photopic versus mesopic conditions. Although the two lens types provided similar visual performance in most areas, the field reductions, together with modest reductions in visual acuity and contrast sensitivity warrant patient education before these lenses are prescribed.

[1] Josephson JI, Caffery BE. Visual field loss with colored hydrogel lenses. *Am J Optom Physiol Opt* 1987; 64:38-40

[2] Daniels K, Rariscotti C, McLin A, et al. Clinical evaluation of dot matrix hydrogel tinted lenses. *Contact Lens Spectrum* 1989; 4(8):69-72

[3] Spraul CW, Heinrich JGR, Gäckle H, et al. Influence of Special-effect Contact Lenses (Crazy Lenses) on Visual Function. *The Contact Lens Association of Ophthalmologists* 1998; 24(1):29-32.

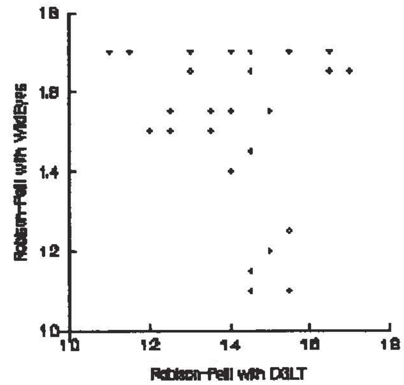
[4] Grey CP:Changes in contrast sensitivity during the first hour of soft lens wear. *Am J Optom Physiol Opt* 1986:63:702-707.

[5] McVey J, Hirsch J: Contrast sensitivity to spatial frequency gratings is enhanced by soft contact oenses compared to spctacles. *Am J Optom Physiol Opt* 1982:59:26-29.

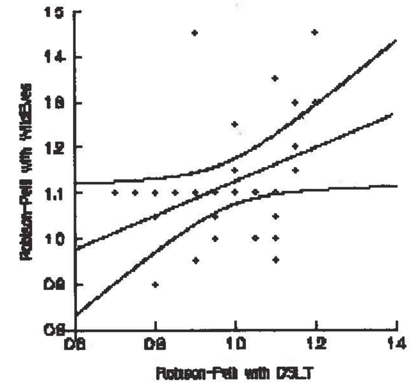
[6] Physicians' Desk Reference for ophthalmology, 1996, p 58-72

[7] Gauthier CA, Grant T, Holden BA. Clinical performance of two opaque, tinted soft contact lenses. *J Am Optom Assoc* 1992; 63:344-9.

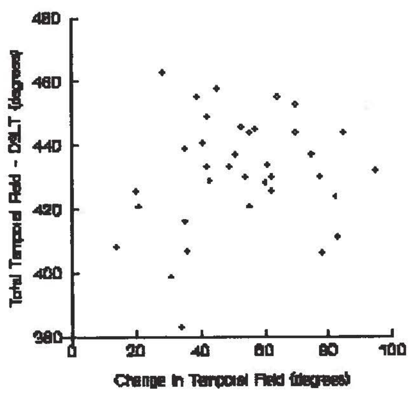
Contrast Sensitivity - Photopic



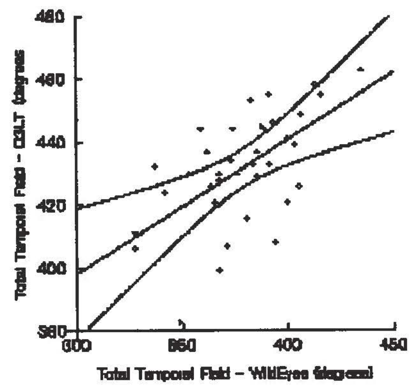
Contrast Sensitivity - Mesopic



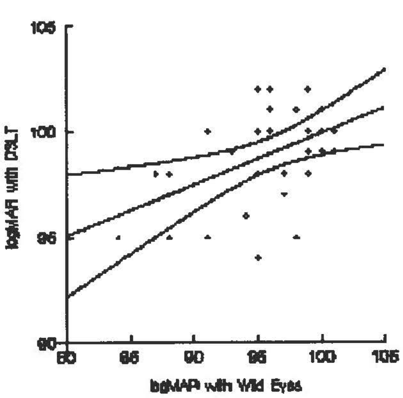
Temporal Field Change with DSLT Initial Temporal Field



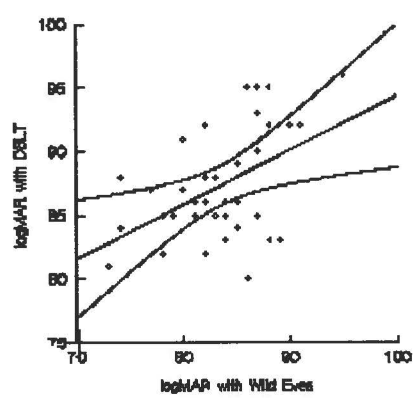
Temporal Visual Field with Lenses



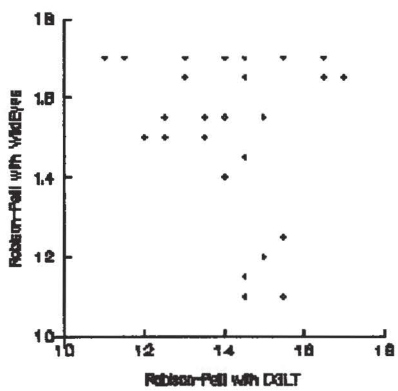
logMAR with lenses - photopic



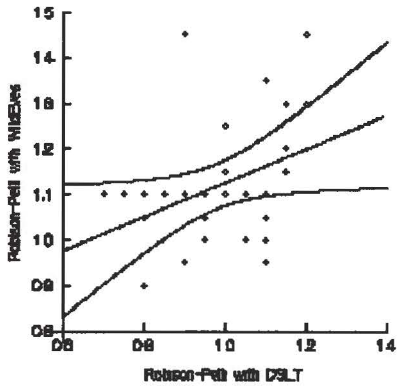
logMAR with lenses - mesopic



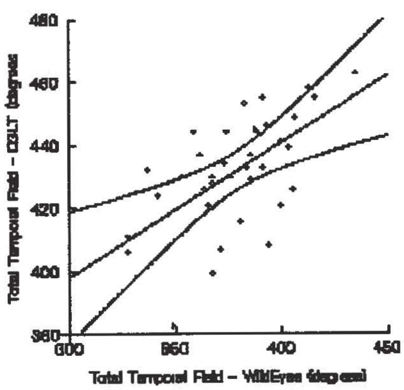
Contrast Sensitivity – Photopic



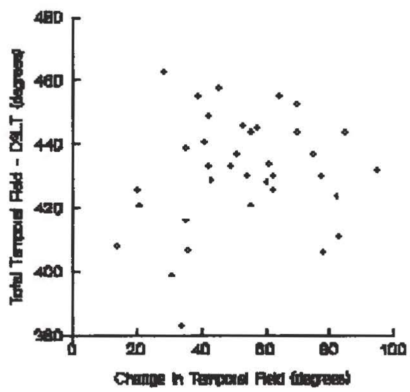
Contrast Sensitivity - Mesopic



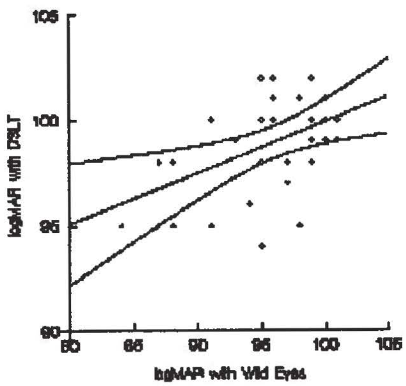
Temporal Visual Field with Lenses



Temporal Field Change with DSLT Initial Temporal Field



logMAR with lenses - photopic



logMAR with lenses - mesopic