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The clinical value of Bausch and Lomb kalichrome and Corning CPF 550 tinted lenses to patients with cataracts: Four cases

Keith Robert Feilzer

Pacific University

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The clinical value of Bausch and Lomb kalichrome and Corning CPF 550 tinted lenses to patients with cataracts: Four cases

Abstract
Tinted lenses have been used in different ways for many years. One application of tinted lenses has been therapeutically to patients with cataracts. In this study, four cataract patients, screened to meet a number of restricting criteria, participated. In an initial examination, acuity, contrast sensitivity, and color vision were tested under habitual conditions, then with a Bausch and Lomb Kalichrome clip-on over the spectacles, and finally with a Corning CPF 550 clip-on over the spectacles. The patients then wore and evaluated each tint for a period of two weeks. Neither tint improved acuity or contrast sensitivity in the clinic. The CPF 550 worked well to relieve the subjective symptoms of two of the patients, while the Kalichrome tint worked quite well for the other two.

Degree Type
Thesis

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THE CLINICAL VALUE
OF BAUSCH AND LOMB KALICHROME
AND CORNING CPF 550 TINTED LENSES
TO PATIENTS WITH CATARACTS:
FOUR CASES

Thesis for partial completion of the requirements for the degree
of
Doctor of Optometry
Pacific University College of Optometry

by
Keith Robert Feilzer

1983

William Ludlam, O.D., Faculty Advisor
The Clinical Value
of Bausch and Lomb Kalichrome
and Corning CPF 550 Tinted Lenses
to Patients with Cataracts:
Four Cases

Keith Robert Feilzer

William Ludlam, O.D.
Faculty Advisor

B+
ABSTRACT

Tinted lenses have been used in different ways for many years. One application of tinted lenses has been therapeutically to patients with cataracts. In this study, four cataract patients, screened to meet a number of restricting criteria, participated. In an initial examination, acuity, contrast sensitivity, and color vision were tested under habitual conditions, then with a Bausch and Lomb Kalichrome clip-on over the spectacles, and finally with a Corning CPF 550 clip-on over the spectacles. The patients then wore and evaluated each tint for a period of two weeks. Neither tint improved acuity or contrast sensitivity in the clinic. The CPF 550 worked well to relieve the subjective symptoms of two of the patients, while the Kalichrome tint worked quite well for the other two.

KEY WORDS

Cataracts, tinted lenses, Corning CPF 550, Bausch and Lomb Kalichrome, acuity, contrast sensitivity, subjective symptoms.
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INTRODUCTION

Colored lenses have been used in efforts to increase vision for over a century. A museum at Fort Necessity displays a pair of old-fashioned spectacles with red glass labelled "Hunting Glasses, about 1830".1 Today, yellow (amber) lenses are utilized for increasing image clarity under foggy, hazy, or overcast conditions by absorbing short wavelength light from the visible spectrum, as well as ultraviolet radiation.

Much controversy surrounds the use of amber colored lenses to improve image quality.2 The general attitude expressed in the literature today seems to have changed little from the ambiguous stance held by Bierman in 1952: "The benefit of yellow lenses depends entirely on the individual; some may be helped while others may be hindered."3 Though many of the marksmen in his study preferred wearing the tint, it had no significant effect on their performance. He attributed any preference to the amber tint to the psychological benefit of wearing a lens which causes the world to appear a little brighter, a characteristic often attributed to the tint. In his study of tinted lenses, Neumueller found that most of his subjects felt that the amber colored lens was the most unpleasant of the several tints they looked through.4

The scattering of light rays, which is responsible for the blue appearance of the sky and the hazy appearance of a smokey
or foggy day, is inversely proportional to the fourth power of the wavelength of light.\textsuperscript{5} Thus, light of 400nm (blue) is scattered considerably more -- about 6.5 times -- than red light of 640nm wavelength. The fundamental action of any tint is to prevent light from entering the eye, and in the case of yellow or amber tints, such as the Bausch and Lomb Kalichrome, the wavelengths intended to be attenuated include the lower (500nm and below) portion of the visible spectrum and the near ultraviolet. In absorbing light from the blue end of the spectrum, yellow tints help to reduce the hazy appearance, which translates, at least in theory, to improved image quality.\textsuperscript{6}

Not only do amber lenses attenuate light of the shorter wavelengths, but they also decrease the amount of light of all wavelengths entering the eye to about 85\%, about 10\% less than white crown transmits.\textsuperscript{7} This, as well as some other effects, leads many to advise against wearing amber lenses for nighttime activities.\textsuperscript{8}

The use of amber tints by color deficient persons is also advised against in the literature.\textsuperscript{6,8} Newman\textsuperscript{9} found ambiguous
results when testing the effects of yellow tints on the color vision of normal observers. Although the Nagel anomaloscope measured no significant deviations for subjects wearing the yellow tint compared to those wearing white crown, the Roth 28-hue (modified 100-hue) color test showed more mistakes with the yellow tint than any other colored or neutral tint tested. The subjective responses to the color perception alteration with the tint were also unfavorable in many subjects. Color alterations are an important consideration when using a yellow tint while performing many everyday activities, such as driving an automobile.

Tinted lenses have long been utilized in the management of many ocular pathologies. Even some systemic pathologies, such as hypertension and depression, have been claimed to be benefited by the wearing of nearly every imaginable tint. Darkly tinted lenses are used routinely for the comfort of retinitis pigmentosa patients in bright sunlight. Protection against the progression of senile cataracts by the use of tinted lenses is mentioned in the literature as early as the 1930's when blue or azure-tinted lenses, intended to absorb heat rays and prevent the cataract's further development, were recommended. Today, some practitioners utilize tints, such as Therminon and Calobar, which absorb both in the ultraviolet and infrared portions of the spectrum, both for relief of glare symptoms due to cataracts and possible prevention of further cataractous development.

The improvement of visual acuity and visual comfort in pat-
ients with cataracts by the use of amber lenses does not seem to be present in the literature. Both optometric and ophthalmologic practitioners have utilized yellow tints, such as the Hazemaster or the Kalichrome, however, to decrease subjective glare symptoms in patients with incipient cataracts. The theoretical basis for this use of the amber tint is the same as the basis for its use in foggy environmental situations, the only difference being the fact that the "haze" due to scattered light is intraocular rather than external.

Only recently, another tinted lens has appeared on the market which is designed to improve visual acuity and contrast, as well as provide comfort, to patients afflicted with certain ocular pathologies. This lens, Corning Glass Work's "CPF 550", was originally intended to provide comfort, better vision, and possibly slowed progression of retinitis pigmentosa by filtering out most of the entering light below 550nm in wavelength. Preliminary experience with the lens, however, has suggested benefits, in one form or another, to patients suffering from corneal problems, retinal degenerative diseases, and those with developing cataracts.

The CPF 550 lens is described in Corning's marketing pamphlets as a red-amber photochromatic lens that filters out 97% of the light stimulating rod receptors in its faded (indoor) state, and more than 99% of this shorter wavelength light in its darkened state. Since scotopic vision is utilized in nighttime and other low-light situations, and this lens is designed to
attenuate wavelengths crucial to scotopic vision, Corning's literature suggests that vision can be reduced in these conditions by the CPF 550 lens, and recommends that the lens not be worn at night when safety is a factor. Corning also recommends that, since wavelengths below 550nm are so strongly filtered and color vision in some patients may be significantly altered, they must be certain beforehand that the lenses will not interfere with their ability to discern colors when safety is a factor.

Since shorter wavelength light is scattered most, the two tints selected for this study were the Bausch and Lomb Kalichrome and the Corning CPF 550, due to their ability to filter out these wavelengths. It is possible that, if short wavelength-absorbing tinted lenses work well in improving acuity, contrast sensitivity, and comfort for patients with cataracts, such patients may postpone cataract surgery for some time.
METHODS

Four patients participated in this study. They were screened from the general clinic population and met the following criteria:

1. The cataracts had to be bilateral.
2. The visual acuity had to be between 20/25 and 20/80 in the better eye.
3. There could be no other known complicating pathologies present.
4. The patient must have had a complete eye examination within one year prior to the study.
5. The patient must be wearing his/her best correction for at least one month prior to the study.

An initial examination was performed on each patient during which visual acuity, color vision, and contrast sensitivity were measured first with the habitual correction only, then with a B&L Kalichrome clip-on over the spectacles, and finally with a Corning CPF 550 clip-on over the spectacles. Visual acuity was measured using a standard Snellen acuity chart at both far and near. Color vision was measured using a Farnsworth Dichotomous D-15 Test under the correct lighting. Contrast sensitivity was measured binocularly using AO Contrast Sensitivity Test Plates.
Each patient was then asked to wear either the Kalichrome or the CPF 550 clip-on for a period of two weeks. During that time they were asked to complete a questionnaire on the performance of the tint under various conditions and activities. At the end of this period, the patients returned the clip-on and the questionnaire and received a new questionnaire and the clip-on that they had not yet worn to evaluate. Two of the patients wore the Kalichrome tint first and the other two wore the CPF 550 tint first. They were instructed to wear the clip-on at all times, except outdoors at night and indoors in the dark. They were also instructed not to wear the tinted lenses while driving, for safety reasons.

RESULTS

Case 1 - Mr. R.O., a 72 year old white male with a history of controlled late-onset diabetes and hypertension with no apparent retinal complications, presents with bilateral posterior subcapsular cataracts and nuclear sclerosis. He has an anterior subcapsular cataract in his right eye only. He complains of very poor vision and reports that bright light bothers him very much. He also reports that he rubs his eyes frequently and that his eyes feel "tired" quite often. There is no evidence of any chronic blepharitis or conjunctivitis. He reports that he is color deficient and has been since birth. His correction is: OD -2.00 sph., OS -1.50-.75x60, +1.50 add OU.
His acuities at the beginning of the study were as follows:

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<tr>
<td><strong>Habitual</strong></td>
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<td>OU 20/40-</td>
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<td><strong>CPF 550</strong></td>
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He shows color deficiency under habitual conditions and with both of the tints, showing no set pattern of misses with any of them. His scores on the Contrast Sensitivity Test Plates are: Habitual- 95, Kalichrome- 94.67, CPF 550- 99.33. These scores are all very similar, with only a slight decrease in contrast sensitivity with the CPF 550.

The patient wore the CPF 550 clip-on first and reported that he felt the tint made him more comfortable on bright sunny days outdoors, but on cloudy days and indoors, they were much too dark to be of value. He could not read with them on and felt that they hindered him while bowling. He reported that he noticed no real difference in his color perception or depth perception while wearing the tint. Overall, he felt that the tint was of little value in improving his visual comfort.

The patient then wore the Kalichrome tint. He reported that it helped him on sunny days by reducing glare. It also helped on cloudy days, but to a lesser degree. He reported that it hindered him only in reading not any other activity. As be-
fore, he noticed no change in his color perception or depth perception. He noticed that with these lenses on, he rubbed his eyes less frequently and his eyes felt more comfortable. Overall, he was pleased with the effects of the Kalichrome.

Case 2 - Mr. K.K., a 75 year old white male in good health with a history of lip cancer presents with bilateral anterior and posterior subcapsular and nuclear cataracts. He complains that he can no longer read fine print (phone book) and that he is bothered by bright lights. His correction is: OD +1.50-1.25x 97, OS +1.00-1.25x82, +2.50 add OU.

The patient's visual acuities at the beginning of the study were:

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<td>Kalichrome</td>
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<td>OS 20/60</td>
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<tr>
<td>CPF 550</td>
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Initial color tests revealed tritan errors under habitual conditions. With both the Kalichrome and CPF 550 he showed errors very similar to the errors he made with spectacles only. His scores on the Contrast Sensitivity Test Plates were: Habitual-72, Kalichrome- 74.67, CPF 550- 85. He showed a very slight decrease in contrast sensitivity with the Kalichrome and a noticeable decrease with the CPF 550.
This patient wore the Kalichrome clip-on first during the trial period. He reported that these lenses improved the clarity of vision and improved his visual comfort quite markedly on sunny days and slightly on cloudy days and indoors under fluorescent lighting. He felt that when he was reading, the print appeared to have more contrast, both in bright and medium light. He noticed no difference when watching television. He reported that traffic lights appeared more distinct, but his depth perception was unaffected. Overall, he felt that the Kalichrome tint produced a slight improvement in his vision and visual comfort.

When the patient wore the CPF 550 tint, he reported that the only improvement in vision and visual comfort was produced in bright light. Otherwise, he felt that the tint was too dark to help him. He was unable to read or watch television through the tint, even in bright light. He noticed no change in his color perception or his depth perception with the tint, but overall, he was uncomfortable wearing the tint because it cut out too much light.

Case 3 - Mrs. T.L., a 75 year old white female in good health and with no significant medical or ocular history presents with bilateral nuclear cataracts. She complains of a general decrease in vision, particularly for finer print. She is slightly bothered by bright light. Her correction is: OD +2.50-1.50x105, +3.00-1.50x80, +2.25 add OU.
The patient's visual acuities at the beginning of the study were:

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<td>Habitual</td>
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<td>Kalichrome</td>
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<td>CPF 550</td>
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The D-15 test with spectacles only revealed no color deficiencies, however the Kalichrome tint induced classic tritan errors into the test results. With the CPF 550 clip-on, only random errors were made. The scores on the Contrast Sensitivity Test Plates were: Habitual- 79, Kalichrome- 68, CPF 550- 79. There was no difference between her habitual and CPF 550 scores. The improvement in total score through the Kalichrome tint was due to an apparent improvement on the finest (6.4 cycles/degree) test plate. The scores on all of the other plates were about the same as they were under habitual and CPF 550 conditions.

The patient wore the Kalichrome tint first during the trial period. She reported that her vision was improved on sunny days and cloudy days. She also reported that reading was slightly more comfortable through the lenses, but she noticed no difference while watching television. She did notice some changes in her color perception, but there was no alteration of her depth perception. Overall, she felt that the Kalichrome tint improved her visual comfort slightly.
When the patient wore the CPF 550 clip-on, she found that her vision was improved on sunny days and somewhat improved on cloudy days and indoors. She reported that reading was easier with the tint and she felt that it did not hinder her in any activity. She also reported that riding in an automobile was more comfortable with the tint, although it did alter her perception of the color of street signs. It had no effect on her depth perception. Overall, the patient was quite impressed with the CPF 550 tint and felt that it worked well to improve her visual comfort.

Case 4 - Mr. R.S., a 58 year old white male in good health and with no medical history presents with bilateral posterior subcapsular cataracts. He complains that his vision has gotten much worse in the last year and that bright lights bother him very much. His correction is: OD pl., OS pl., +2.25 add OU.

The patient's visual acuities at the beginning of the study were:

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<td>CPF 550</td>
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The D-15 color test revealed one deutan error with spectacles only. With the Kalichrome tint, the patient made several tritan
errors and with the CPF 550 tint, he made a few random errors. The results of the Contrast Sensitivity Test Plates were: Habitual- 92, Kalichrome- 91, CPF 550- 95. All scores are very similar and the scores on individual test plates were very similar under all three conditions.

This patient wore the CPF 550 clip-on first during the trial period. He reported that it improved the clarity of his vision very much on sunny days. It also improved on cloudy days and indoors under both fluorescent and incandescent lighting. He felt that the tint reduced much of the glare from fluorescent lights, allowing him to perform his job more comfortably, and to read more comfortably under both bright and medium light. He did not feel that the tint hindered him in any activity. He reported that riding in a car was much more comfortable with the CPF 550 tint, although it did make traffic lights a little hard to distinguish. Overall, this patient greatly appreciated the effects that the CPF 550 had in reducing glare and improving his visual comfort.

The patient then wore the Kalichrome tint for the trial period. He reported that the tint helped only very slightly on sunny days, but not at all on cloudy days or while indoors. He was uncomfortable reading and working while wearing the tint. He also said that the tint was too "bright" for comfort while he was riding in a car, although he noticed no changes in the appearance of street signs or traffic lights. He reported that
there were no differences in depth perception or adaptation to light changes experienced while wearing the Kalichrome tint. Overall, this patient did not like the effects of the Kalichrome tint at all and felt that it did very little to improve his visual comfort.

DISCUSSION

None of the four patients in this study experienced a significant improvement in visual acuity, as measured with the Snellen Acuity Chart, with either of the two tints. Such an improvement, with any tint, has not been quantified in the literature either. Bailey, et al. (1978), tested several methods of applying yellow filters therapeutically to patients with cataracts and found no measureable improvement in acuity with any of them. It is not clear whether tinted lenses of any kind will produce a significant improvement in Snellen acuity in patients with cataracts.

Contrast sensitivity, as measured with the AO Contrast Sensitivity Test Plates, was not enhanced with either of the tints. One patient showed an enhancement for one plate with only the Kalichrome filter. It is not clear whether this enhancement was genuine, or if it was merely an artifact of testing. Dr. Ian Bailey, O.D., in his work with cataract patients,
found no enhancement of contrast sensitivity as a result of wearing yellow lenses. Brooke and Hays (1983) found no enhancement of contrast sensitivity in normal patients wearing yellow filters either. At this time, it is not apparent that the CPF 550 tint will enhance contrast sensitivity, at least not clinically, to any measureable degree either.

With both the Kalichrome and CPF 550 tints, errors in color vision were seen in all patients. On the D-15 test, the Kalichrome filter caused two of the patients to make tritan errors who had otherwise not made such errors. The one patient who had made tritan errors under habitual conditions made nearly identical errors while wearing the Kalichrome tint. Apparently the Kalichrome tint made the patients artificially tritanopic. With the CPF 550 tint, only random errors were made on the D-15 test by all four patients. Changes in color vision should be considered as a possible undesirable side-effect when applying the Kalichrome or CPF 550 tints therapeutically to patients with cataracts.

Although none of the four patients demonstrated any measureable improvements in either Snellen acuity or contrast sensitivity in the clinic, there were instances when all four of them reported subjective improvements in vision while wearing the tints during their everyday activities. All of the patients stated that they had felt an improvement in the clarity and distinctness of their vision on sunny days with both the Kalichrome
and CPF 550 filters. Beyond their effects on sunny days, however, the two tints divide in their subjective effects on patients. Two of the patients felt they were helped considerably by the CPF 550 filter, while the other two stated that it was much too dark to be of any value. It is interesting to note that the two who felt the tint worked well had the better visual acuities upon initial examination, while those who did not like the overall effects of the CPF 550 tint had considerably worse acuities. CPF 550 filters out a considerable amount of visible light, especially in its darkened state, and it is likely that the tint is too dark to be of value to those with very advanced cataracts, where the amount of light entering the eye is already very restricted. If the visual acuity has not been reduced too much, the CPF 550 works well to improve vision and decrease the asthenopia that accompanies incipient cataracts.

The Kalichrome tint worked quite well to improve the visual comfort of the two patients with the more advanced cataracts and reduced acuities. It was, however, soundly rejected by both of the patients whose cataracts had only reduced the visual acuity a small amount. Both of the patients who preferred the Kalichrome tint said that they were able to read a little more comfortably with the tint in place and that, while glare was reduced, the tint "brightened" up their visual environment. While this brightening was considered an asset by two of the patients, it was considered a liability by the other two. Both of them reported that the world was just too bright to be comfortable
CONCLUSION

Although this study was not intended to present any statistically evaluated data, it did show that there are instances where either the Kalichrome or CPF 550 tint can be therapeutically applied to patients with cataracts. It seems to indicate that the Kalichrome tint is useful to those patients whose cataracts have reduced the visual acuity more than two to three lines. If the acuity has not been reduced more than about three lines, the CPF 550 tint has application.

There are other filters on the market that may also be beneficial to patients with cataracts. The photochromic grays and browns may be useful, provided they filter out enough high frequency light. Corning's new CPF 527 and CPF 511 tints may also be useful, as the CPF 550 has proven to be. It is important that the eye care practitioner remember tinted lenses as a possible avenue of approach when attempting to manage the problems seen in patients with cataracts.

while they were wearing the Kalichrome tint.
APPENDIX A

Human Subjects Release Form

Used For Study
1. INSTITUTION
A. Title of Project: The Clinical Value of Tinted Lenses to Patients With Lenticular Opacities
B. Principal Investigator: Keith R. Feilzer
C. Faculty Advisor: William Ludlam, O.D.
D. Location: Pacific University College of Optometry
E. Date: Spring 1983

2. DESCRIPTION OF PROJECT
This project is designed to determine the value of tinted lenses to patients with cataracts. Two different tints will be evaluated to determine their effects on vision. Your visual acuity and color vision will be measured while you are wearing the tinted lenses. You will also wear the lenses outside the clinic in your daily life for a period of two weeks for each lens.

3. DESCRIPTION OF RISKS
Tinted lenses reduce the overall amount of light entering the eye. The tints should not be worn in low light situations such as outdoors during nighttime or in a very dimly lit room. Because colored lenses may also alter color perception, they should not be worn when you are driving or doing other tasks in which color vision accuracy is a safety factor.

4. DESCRIPTION OF BENEFITS
This research project will serve to increase the understanding of tinted lenses and how they might benefit patients with cataracts. If it is determined that one or both of these tints significantly your own vision or visual comfort, they will be available to you for purchase at cost.

5. COMPENSATION AND MEDICAL CARE
If you are injured while participating in this experiment, it is possible that you will not receive compensation or medical care from Pacific University, the experimenters, or any organization associated with this experiment. All reasonable care will be used to prevent injury, however.

6. ALTERNATIVES ADVANTAGEOUS TO SUBJECTS
None applicable.

7. OFFER TO ANSWER ANY INQUIRIES
The experimenter will be happy to answer any questions that you may have at any time during the course of this experiment.

8. FREEDOM TO WITHDRAW
You are free to withdraw your consent and to discontinue your participation in this project at any time without prejudice to you.

I have read and understand the above. I am 18 years of age or over.

Printed Name __________________________ Signature __________________________
Address __________________________ Date __________________________
Phone __________________________
APPENDIX B

Patient Record
Used For Study
PATIENT RECORD

Name ____________________________

Address __________________________

Symptoms __________________________

Case History ________________________

Visual Acuity

Habitual

Far OD / Far OD / Far OD
OS / OS / OS
OU / OU / OU
Near OD / Near OD / Near OD
OS / OS / OS
OU / OU / OU

Parnsworth Dichotomous Test  D-15

Habitual

Kalichrome

CFF550
Patient
Contrast Sensitivity Record

Habitual

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Kalichrome

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CPP 550

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APPENDIX C

Patient Questionnaire

Used For Study
Please answer the following questions as completely as you can.

1) Do you experience any improvement in the clarity or distinctness of your vision under the following conditions?
   - Sunny days outdoors
   - Cloudy/rainy outdoors
   - Indoors in fluorescent lighting
   - Indoors in regular lighting
   - Other (please specify)

2) Do you feel these tinted lenses helped you in doing any particular activities during the trial period? YES NO (circle)
   If yes, please describe the activity and how the lenses helped.

3) Do you feel these tinted lenses hindered you in any activity during the trial period? YES NO (circle)
   If yes, please describe the activity and how the lenses hindered.

4) Did these tinted lenses help in:
   - Watching television?
   - Reading under medium light?
   - Reading under bright light?

5) Did you ride in a car with these tinted lenses on? YES NO (circle)
   If yes, was it more or less comfortable than without the lenses.
   Did you notice any change in the appearance of street signs, traffic lights, or anything else? Please be specific

6) Did you notice a difference in how quickly your eyes adapted to changes in lighting while you were wearing the lenses? (example: coming in from bright outdoor light to dimmer indoor lights)

7) Did the lenses have any effect on your depth perception? YES NO
   If yes, how did it affect it?
8) Did the tinted lenses have any effect on your overall visual comfort? (example: Do your eyes feel less tired at the end of the day?) Please be as specific as possible.

9) Please take the remaining space and describe in any way you can anything unusual (good or bad) that you noticed about the tinted lenses, any effects they had on your vision or comfort, and your overall impression of the tinted lens.
REFERENCES


13. Corning Glass Works Marketing Literature pamphlets OPM-1 through OPM-6 are available by writing:
   Technical Products Division
   Corning Medical Optics MP 21-2
   Corning Glass Works
   Corning, New York 14831

15. Personal communication with Ian Bailey, OD, Associate Professor, University of California, Berkeley.