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Gunnar Optiks Study: Accommodation and Symptoms (2007)

Description
A crossover study of 36 subjects was conducted to study the difference between *Gunnar Optiks* computer spectacles and placebo lenses. The two pairs of eyeglasses were in similar frames, and both sets of lenses were made of similar resin with antireflective coating, but the placebo lenses were made without optical power or tint. Measurements of accommodation and subjective symptoms experienced with each type of glasses were made. Chi-squared testing revealed a significant difference in the following four symptoms: irritation or burning of the eyes, tearing, or watery eyes, dry eyes, and tired eyes. Pupil size was significantly different (p=0.001), but differences in the accommodative responses to the two types of eyeglasses were not significant.

Keywords
computers, vision, eyeglasses, glasses, accomodative response

Disciplines
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Gunnar Optiks Study: Accommodation and Symptoms (2007)

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Abstract

A crossover study of 36 subjects was conducted to study the difference between Gunnar Optiks computer spectacles and placebo lenses. The two pairs of eyeglasses were in similar frames, and both sets of lenses were made of similar resin with antireflective coating, but the placebo lenses were made without optical power or tint. Measurements of accommodation and subjective symptoms experienced with each type of glasses were made. Chi-squared testing revealed a significant difference in the following four symptoms: irritation or burning of the eyes, tearing, or watery eyes, dry eyes, and tired eyes. Pupil size was significantly different (p=0.001), but differences in the accommodative responses to the two types of eyeglasses were not significant.

Background

This study was designed to evaluate Gunnar Optiks eyeglasses. According to the company website (www.gunnaroptiks.com), these computer eyeglasses are designed to deliver the following to the eyes:

- Glare reduction
- Higher humidity
- Extraneous light diminution
- Screen magnification
- Ultraviolet (UV) protection

Qualifications

Those qualified for this study had to meet the criteria of 20/20 visual acuity in each eye with either no optical correction, or contact lens correction. If with correction, the refractive error needs to be within +/-0.50 diopter spherical equivalent of no optical power, and the subject has to be willing and able to wear contacts until the study is complete. No history of long-term or continuous eyestrain, but use of a computer at least one hour per day. These criteria resulted in disqualification of three would-be participants.

Methods

Subjects were between the ages of 22 and 39, with a mean age of 24 years. There were 37 subjects who qualified for the study, and 36 who completed it. 18 were male and 19 were female.

After initial recruitment and qualification, each participant had their visual symptoms surveyed with a symptom survey (see Appendix).

Because it was a crossover design, each subject was given either a pair of low-power (+0.50 D) spectacles with a light yellow tint (the Gunnar design), or a placebo pair of clear plano (no optical power) spectacles in an identical frame. These were sent home with each subject to evaluate for one week, for at least one hour per day, while using a computer. The subjects were further instructed to complete the symptom survey online three times during the week.

After a week of randomized spectacle wear, the participants were be called in to begin the study. At the first of two visits, the subjects read under of the following conditions for 5 minutes each:

- With five 15W compact fluorescent lights, causing 300W equivalent glare. These lights have a color temperature of 6500 K.
- With low (about 5%) contrast text
- With control text (12-point, full contrast)

Each condition was tested in Latin square order while the research subject read an electronic book with either placebo glasses or yellow-tinted, low-power computer glasses (the Gunnar design). During reading, participants had their accommodation measured with the Grand Seiko open-field autorefractor. After each condition, the Digital Symptom Survey was administered.

After these in-lab measurements at the end of the first week, the subjects turned in their first pair of experimental spectacles, and are given the other type of eyeglasses (placebo versus low-power spectacles with a light tint) for one additional week. During the second week, the symptom survey was administered online once again, asking the participants about their experience while using the glasses on the computer.

After the second week of spectacle wear, one additional visit was be scheduled with the same three conditions as the first visit (glare, low contrast, and control). At this second (and last) visit, both pairs of spectacles will be given to the subjects to choose, so that they may keep their preference. Preference exit surveys will be administered to close the study.

Results

Twenty-three symptoms were surveyed both in-office and at

home for this study. Thus far, the in-office surveys have been analyzed.

Dividing the subjective surveys into those caused by external factors, such as glare and dryness, and those caused by internal factors, such as blur and double vision, some statistically significantly differences were found.

Internal symptoms surveyed included:

1. Sore eyes, painful eyes, or ache in or around eyes
2. Double vision
3. Blurred vision
4. Headache
5. Eye strain or pulling of the eye muscles

For these five internal symptoms, there was no significant difference found between subjects wearing each type of eyeglasses using a Chi-square distribution test.

External symptoms surveyed included:

1. Irritation or burning of the eyes
2. Tearing, or watery eyes
3. Dry eyes
4. Tired eyes
5. Bothered by brightness
6. Bothered by glare
7. Computer screen fonts look too small
8. Computer screen colors are distorted
9. Computer screen clarity is poor

On Chi-square distribution testing, the first four of these external symptoms showed significant differences between the two pairs of glasses (Gunnar and placebo, $p = 0.001$). Note that three out of four of these symptoms are related to dry eyes.

The last five external symptoms, designed specifically for this study, did not show significance. These were designed to explore the magnification and tint differences of the two types of eyeglasses.

Other symptoms surveyed included:

1. Desire to blink harder
2. Desire to blink more often
3. Difficult to concentrate on the text
4. Difficult to comprehend the text
5. Difficult to remember the text
6. Feel sleepy or eyelids feel heavy
7. Feel dizzy
8. Desire to move closer or further away from the screen
9. Desire to stop the condition or take a break

None of these symptoms showed significant differences between the Gunnar and placebo glasses.

Lastly, in the exit survey, 59% of the subjects preferred the yellow-tinted magnifying glasses (the Gunnar design). However, the subjects also admitted to wearing their glasses for less than one hour a day on their computers.

This can be most likely explained by the fact that these subjects were recruited from those least likely to wear corrective spectacles. Those who needed correction had chosen to wear contact lenses, in many cases to avoid using spectacles in the first place.

Objective data were also obtained using the Grand Seiko open-field autorefractor. These data were as follows:

1. For the dependant variable, the spherical equivalent accommodative response mean, there was no significant difference ($p=0.56$).

2. There was a significant difference for the accommodative response standard deviation ($p=0.01$). For both pairs of glasses, at the 95% Confidence Interval:

Accommodation	Gunnar Lenses	Placebo Lenses
Mean	1.092	0.675
Standard Error	0.156	0.158
Difference	61.940	63.673
Upper Bound	0.780	0.359
Lower Bound	1.404	0.990

3. For the dependant variable pupil size, there was a significant difference ($p < 0.001$). For both pairs of glasses, at the 95% Confidence Interval:

Pupil Size	Gunnar Lenses	Placebo Lenses
Mean	3.436	3.273
Standard Error	0.089	0.089
Difference	37.848	38.240
Upper Bound	3.256	3.092
Lower Bound	3.617	3.454

4. There was no significant difference for pupil standard deviation ($p=0.087$). For both pairs of glasses, at the 95% Confidence Interval:

Pupil Standard Deviation	Gunnar Lenses	Placebo Lenses
Mean	0.309	0.286

Standard Error	0.014	0.015
Difference	53.195	55.555
Upper Bound	0.280	0.257
Lower Bound	0.337	0.315

Variability tended to be a little larger for the tinted Gunnar glasses. Pupil size was larger for these glasses, which makes sense due to the tint.

This analysis and the analysis of the symptom scores was by mixed model analysis of variance with condition and type of glasses.

Conclusions and Recommendations

The Gunnar Optiks glasses reduced external symptoms of irritation or burning of the eyes, tearing, or watery eyes, dry eyes, and tired eyes. They also affected pupil size, but not accommodation.

Compliance with either pair of computer spectacles was generally less than one hour a day, even among those who worked on computers at least four hours a day. Compliance could potentially be increased by making prescription Gunnar Optiks available to regular spectacle wearers, those who are accustomed to eyeglass wear and therefore more likely to wear them.

In light of the two differences between the Gunner Optiks and placebo glasses, namely the optical power and tint, further research is indicated to explore the following:

1. Why are the external symptoms related to dry eyes subjectively different when the curvature of the lenses and frames was the same in the two types of eyeglasses?

2. The effects of these two types of eyeglasses on squinting have not been explored. It can be investigated with electromyography (EMG) of the eyelid.

3. Objective measurement of dry eye has also not been explored, but could be using various clinical tests.

These questions were explored in a follow-up study in 2008.

Notes and references

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Appendix: VERL Digital Sensation Questionnaire

For each of the following symptoms, circle the word that best represents the severity of each item during reading while wearing your computer glasses:

Sore eyes, painful eyes, or ache in or around eyes

none mild moderate bad severe

Double vision

none mild moderate bad severe

Blurred vision

none mild moderate bad severe

Headache

none mild moderate bad severe

Eyestrain or pulling of the eye muscles

none mild moderate bad severe

Irritation or burning of the eyes

none mild moderate bad severe

Tearing, or watery eyes

none mild moderate bad severe

Dry eyes

none mild moderate bad severe

Tired eyes

none mild moderate bad severe

Bothered by brightness

none mild moderate bad severe

Bothered by glare

none mild moderate bad severe

Computer screen fonts look too small

none mild moderate bad severe

Computer screen colors are distorted

none mild moderate bad severe

Computer screen clarity is poor

none mild moderate bad severe

Desire to blink harder

none mild moderate bad severe

Desire to blink more often

none mild moderate bad severe

Difficult to concentrate on the text

none mild moderate bad severe

Difficult to comprehend the text

none mild moderate bad severe

Difficult to remember the text

none mild moderate bad severe

Feel sleepy / Eyelids feel heavy

none mild moderate bad severe

Feel dizzy

none mild moderate bad severe

Desire to adjust the viewing distance (move closer or further away from the screen)

none mild moderate bad severe

Desire to stop the condition or take a break

none mild moderate bad severe