The PRIO Computer Vision Tester; Is it a Useful Tool or Merely a Gimmick?

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Abstract

Many people suffer from Computer Vision Syndrome of CVS. CVS can cause a variety of symptoms, many of which are related to the eye. The PRIO Computer Vision Tester has been manufactured to more accurately determine what spectacle prescription should be given specifically for computer use. Differences in computer spectacle prescriptions have been noted using the PRIO Computer Vision Tester versus those found using more traditional methods. This study has been conducted to determine the quantity of these differences as well as to determine if a consistent factoring figure can be used in conjunction with traditional methods to mirror the results of the PRIO Computer Vision Tester. The results of this study concluded that there is in fact a considerable difference in the final computer prescriptions found using the PRIO Computer Vision Tester and the commonly used Snellen acuity card. A consistent subjective factoring figure was not found due to the variances found from patient to patient. However, an objective factoring figure could have been taken into consideration with the majority of the patients studied.

In today's fast paced world, computers play a major role in people's everyday lives. From the workplace to the home, computers are commonplace. It is thought that about half of the workforce, or around seventy-five million people use computers on a daily basis in the United States alone (1). Many of these people suffer from a disorder known as Computer Vision Syndrome (CVS). Discussion on what the signs and symptoms of CVS are, along with ways to treat those symptoms will be addressed throughout this paper. The main focus of this paper will be to compare and contrast computer spectacle prescriptions found using traditional methods (Snellen) versus those found using a new device called the PRIO Computer Vision Tester.

CVS if often characterized by symptoms such as: headaches, neck and shoulder pain, burning and tired eyes, blurred vision, double vision, changes in spectacle prescription over time, and loss of focus. Studies have shown that while these symptoms may occur during prolonged near point exposure to printed material, they generally occur at a lesser degree than when compared to those symptoms suffered when exposed to material displayed on a computer monitor. The reason human eyes respond better to printed material versus that presented on a video display terminal is easily explained. Printed material has well defined borders, usually existing of black characters on a white background. These well-defined borders allow healthy human eyes to focus and remain on plain with little effort. On the other hand, video display terminal material is made up of electronically generated characters (Gaussian image) which are made up of individual pixels. A pixel is created when an electron beam strikes the phosphor-coated back surface of a computer screen. In contrast to printed materials, healthy human eyes have a harder time fixating on video display terminal material because the individual pixels are brightest in the center and diminish in brightness towards the edges, thus creating blurred edges. Without sharp borders, human eyes tend to wonder towards the Resting Point of Accommodation (RPA). The RPA is an imaginary point behind the point of fixation. As a result, the eyes have a tendency to jump back and forth between the RPA and the point of fixation hundreds even thousands of times when viewing a video display terminal. The ciliary muscle controls accommodation by relaxing and tightening the lens zonules which in turn helps the eyes maintain focus on near point material. When the eyes are drifting back and forth between the point of fixation and the RPA, as when viewing a video display terminal, the ciliary muscle is constantly flexing and relaxing. It is believed that this continual use of the ciliary muscle is what causes the symptoms experienced with Computer Vision Syndrome (2).

The PRIO Corporation located in Beaverton Oregon, manufactured a near point tester that exactly duplicates the Gaussian image produced by a video display terminal (1). The device called the PRIO Computer Vision Tester was designed to easily attach to the near-point rod of any phoropter. Using the plano mirror of a retinoscope, an examiner then performs a form of MEM retinonoscopy or plus (+) acceptance over the patients best corrected distance prescription (until neutrality is seen with the retinoscope) through the hole in the middle of the device. This is done to find the patients computer lag of accommodation (plus (+) acceptance until neutrality). Once the computer lag of accommodation is found, the examiner than refines the prescription subjectively to determine the final computer prescription.

This study will take into account objective findings using MEM retinoscopy (plus (+) acceptance until neutrality), as well as subjective findings, using both the PRIO Computer Vision Tester and a Snellen acuity card attached to the near-point rod of a phoropter. All testing was conducted at 40 centimeters in order to keep all findings consistent. The following tables and graphs will show how the study was conducted as well as what results were found when comparing the final computer prescriptions using both the PRIO Computer Vision Tester and Snellen acuity cards.

AGE	SUBJECTIVE REFRACTION	OBJECTIVE PRIO REFRACTION *	SUBJECTIVE PRIO REFRACTION *	OBJECTIVE SNELLEN REFRACTION *	SUBJECTIVE SNELLEN REFRACTION *
23	-1.25 OD -1.25 OS	1.00	0.75	0.50	0.75
18	-.25 OD -.25 OS	1.25	0.50	0.50	0.50
30	-3.25-2.25X56 OD -4.50-2.00X125 OS	1.25	0.75	0.75	0.50
32	-4.50-1.00X95 OD -4.75-1.00X105 OS	1.25	0.75	0.50	0.50
21	-2.50-.50X165 OD -1.75-.50X45 OS	1.00	1.00	0.50	0.50
19	-1.25-.50X95 OD -1.25-1.00X90 OS	0.75	1.00	0.50	0.25
39	-.25 OD -.25 OS	0.75	0.50	0.50	0.50
27	PLANO-.50X5 OD -.25 OS	1.25	0.75	0.50	0.75
41	-.75-.50X95 OD -.75-.50X100 OS	1.25	0.75	0.50	0.50
22	+1.00-.75X105 OD +1.00-.75X80 OS	1.00	0.50	0.50	0.00
35	+.75-2.75X125 OD +.75-2.50X65 OS	1.00	0.75	0.50	0.50
25	-.25 OD -.25 OS	1.50	1.00	0.75	0.50
20	-.50 OD -.50 OS	1.00	1.00	0.50	0.50
36	-4.50-1.50X180 OD -4.50-1.75X170 OS	1.00	0.50	0.75	0.50
28	-1.00-.25X160 OD -.25 OS	1.00	0.75	0.50	0.50
36	-2.25-.50X55 OD -3.25-.50X153 OS	1.25	0.75	0.50	0.50
34	-1.25-2.50X103 OD -1.50-1.50X60 OS	0.75	0.50	0.50	0.25
29	PLANO OD PLANO OS	1.00	0.75	0.50	0.50

AGE	SUBJECTIVE REFRACTION	OBJECTIVE PRIO REFRACTION *	SUBJECTIVE PRIO REFRACTION *	OBJECTIVE SNELLEN REFRACTION *	SUBJECTIVE SNELLEN REFRACTION *
27	-1.00 OD -.75 OS	1.00	0.50	0.50	0.50
22	-3.00 OD -3.50 OS	1.25	1.00	0.75	0.50
29	-.75-.25X90 OD -.75 OS	1.25	0.50	0.50	0.50
31	-1.00 OD -.75-.50X20 OS	1.50	1.00	1.00	0.75
31	.25 OD -.75 OS	0.75	0.75	0.25	0.25
25	-1.75 OD -1.75 OS	1.00	1.00	0.50	0.50
32	-7.25-2.50X165 OD -7.00-2.25X75 OS	0.75	0.75	0.50	0.50
28	PLANO-2.00X180 OD -1.00-.50X170 OS	0.75	1.00	0.50	0.50
20	-1.25-1.25X170 OD -.50-2.50X30 OS	1.00	1.00	0.50	0.50
17	-2.75 OD -2.75 OS	0.75	0.75	0.50	0.50
20	PLANO-.75X170 OD PLANO-.50X180 OS	0.50	0.25	0.00	0.25
26	-1.50 OD -1.50 OS	1.25	1.00	0.75	0.50
26	-2.50 OD -2.50 OS	1.25	0.75	0.75	0.50
32	PLANO OD -.25 OS	1.00	0.50	0.50	0.50
32	-.25-.50X149 OD -.50-.25XS55 OS	1.00	0.75	0.50	0.50
19	PLANO OD PLANO OS	1.25	1.00	0.50	0.50
21	-4.00 OD -3.75-.75X180 OS	1.00	0.75	0.50	0.25
15	PLANO OD PLANO OS	0.75	0.25	0.50	0.25
20	-.25 OD -.25 OS	1.00	0.50	0.50	0.25
21	-.25 OD -.25 OS	1.50	1.00	0.75	0.50

AGE	SUBJECTIVE REFRACTION	OBJECTIVE PRIO REFRACTION *	SUBJECTIVE PRIO REFRACTION *	OBJECTIVE SNELLEN REFRACTION *	SUBJECTIVE SNELLEN REFRACTION *
20	-.25 OD PLANO -.25X90 OS	0.75	0.50	0.25	0.00
25	+.50 OD +.50 OS	0.75	1.00	0.50	0.50
31	PLANO OD PLANO OS	1.00	0.75	0.50	0.25
28	+.50-.75X115 OD +1.00-1.50X53 OS	1.25	0.75	0.50	0.50
33	+2.00 OD +2.25 OS	1.00	0.75	0.50	0.25
Mean: 26.65		1.035	0.744	0.529	0.442
Median: 27		1.000	0.750	0.500	0.500

Average difference between objective PRIO and objective Snellen: 0.506 diopters
Average difference between subjective PRIO and subjective Snellen: 0.302 diopters

* Plus (+) power in diopters over subjective distance prescription

The above study included 43 subjects with an average age of 26.65, with subjective distance refraction's revealing 2 simple hyperopes, 18 compound myopic astigmats, 14 simple myopes, 4 mixed astigmats, and 5 emmetropes. During each examination MEM retinoscopy (plus (+) acceptance until neutrality) was performed on each subject at 40 cm using both the PRIO Computer Vision Tester and a Snellen acuity card to find the lag of accommodation (point of neutrality using a retinoscope). All subject's lags of accommodation (points of neutrality using a retinoscope) were found over their distance prescriptions. Retinoscopy was performed at 40cm, and plus (+) power was added in 0.25 diopter steps until neutrality was seen. The amount of plus(+) power found, was called the lag of accommodation. After each subject's lag of accommodation (point of neutrality using a retinoscope) was found a subjective refraction was again performed at 40 cm using both the PRIO Computer Vision Tester and a Snellen acuity card.

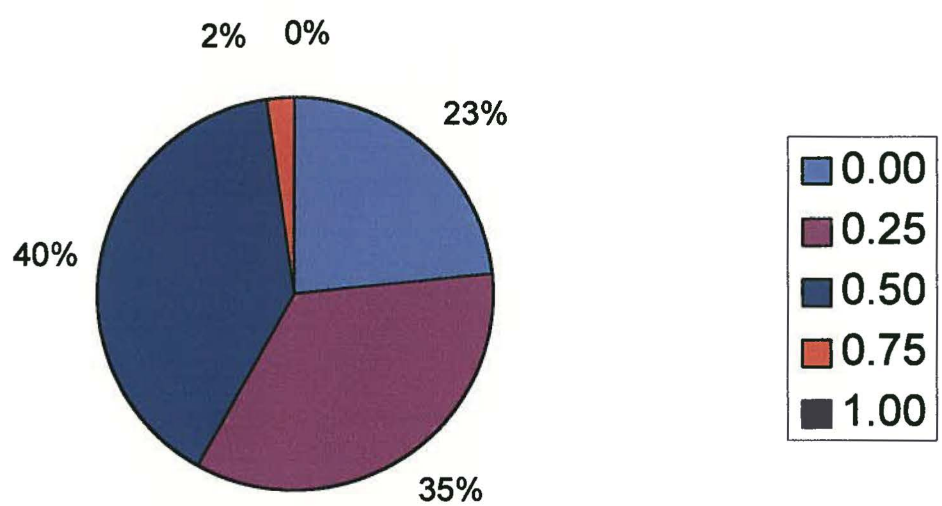
The study findings showed an average objective (MEM or plus (+) acceptance until neutrality) PRIO refraction of +1.035 diopters, an objective (MEM or plus (+) acceptance until neutrality) Snellen refraction of +0.529 diopters, a subjective PRIO refraction of +0.744 diopters and a subjective Snellen refraction of +0.442 diopters. An average difference of 0.506 diopters was also found between the objective PRIO refraction (MEM or plus (+) acceptance until neutrality) and the objective snellen refraction (MEM or plus (+) acceptance until neutrality), with the PRIO Computer Vision Tester showing more plus (+). An average difference of 0.302 diopters was also found between the subjective PRIO refraction and the subjective Snellen refraction, again with PRIO Computer Vision Tester showing more plus (+). The study medians were as follows:

Age	Objective PRIO Refraction*	Subjective PRIO Refraction*	Objective Snellen Refraction*	Subjective Snellen Refraction*
27	+1.00	+0.75	+0.50	+0.50

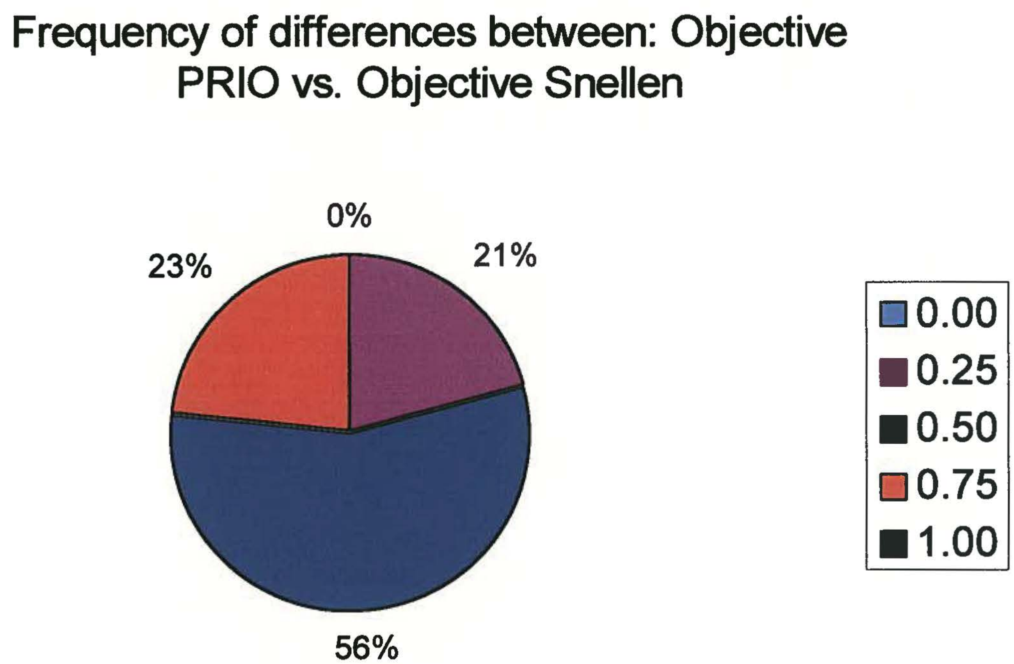
*Plus (+) power in diopters over subjective distance prescription.

Of the 43 subjects 17 showed a subjective difference of 0.50 using the PRIO Computer Vision Tester compared to the Snellen acuity card, 15 showed a difference of 0.25, 1 showed a difference of 0.75, and 10 did not show any difference. This is shown in the following pie chart.

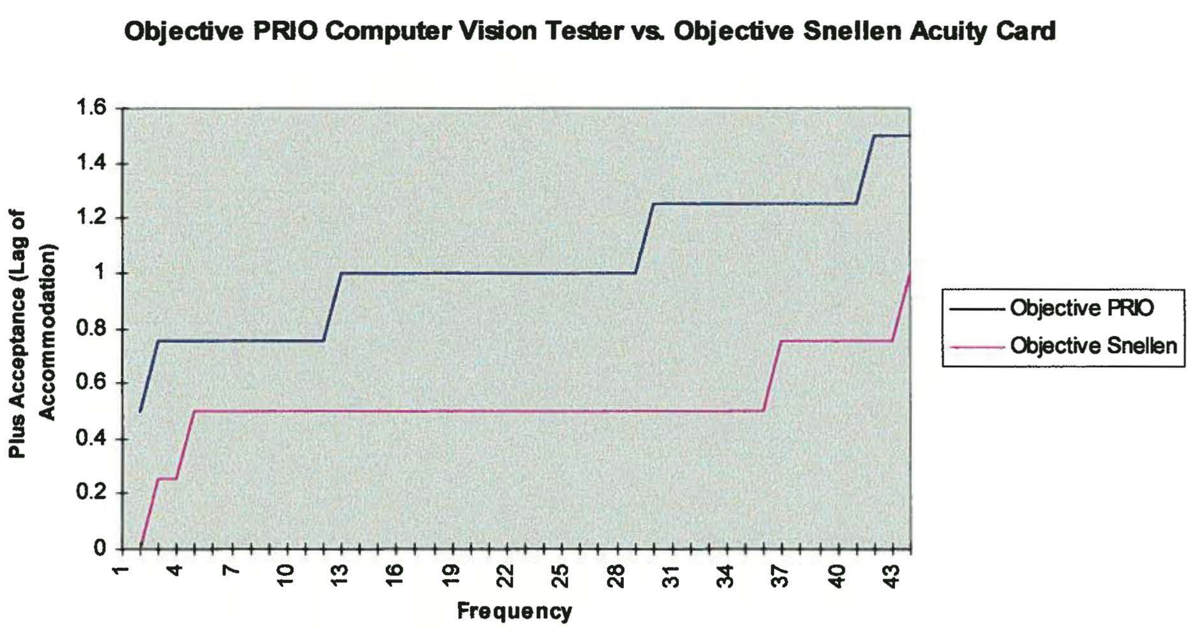
Frequency of differences between:
Subjective PRIO vs. Subjective Snellen



The following pie chart shows that 24 of the subjects studied had a 0.50 diopter objective difference between the two systems, 10 showed a 0.75 diopter difference, and 9 showed a difference of 0.25 diopters.



The following line graph shows the objective PRIO Computer Vision Tester prescriptions found versus those found using a Snellen acuity card.



In conclusion, the above study showed that the PRIO Computer Vision Tester does in fact reveal different objective and subjective findings when compared to a Snellen acuity card. The results concluded that 100 percent of the 43 subjects studied showed more plus (+) objectively with the PRIO Computer Vision Tester. Only 56 percent showed an objective difference near the average objective difference of 0.506 diopters, although 79 percent revealed an objective difference ranging from 0.50 to 0.75 diopters. This finding acknowledges the fact that the majority of the subjects were able to take at least 0.50 diopters over and above their objective Snellen acuity card findings. Subjective findings showed that 58 percent of the subjects studied revealed a difference of 0.25 diopters or less between the PRIO Computer Vision Tester and a Snellen acuity card. Therefore 42 percent showed a subjective difference of 0.50 diopters or more. Thus, the subjective findings did not allow for a consistent factoring figure to be used in conjunction with a Snellen acuity card, to mirror the results of the PRIO Computer Vision Tester. However, an objective factoring figure of +0.50 diopters could be taken into consideration. The majority (79%) of the subjects studied showed that the PRIO Computer Vision Tester revealed 0.50 to 0.75 diopters more plus (+) than the Snellen acuity card. The remaining 21 percent of the subjects studied showed an objective difference of 0.25 diopters with none of the subjects showing a difference more than 0.75 diopters. This proves that an eye care professional could in theory use +0.50 diopters over his or her objective Snellen acuity findings (MEM or plus (+) acceptance until neutrality) to prescribe computer spectacles masking those prescriptions found using the PRIO Computer Vision Tester alone. As always there are exceptions to every rule; all patient findings and complaints should be taken into consideration before applying any factoring figure. This study concludes that the PRIO Computer Vision Tester is not absolutely necessary to adequately diagnose and treat CVS. However, the PRIO Computer Vision Tester can help an eye care professional to more accurately determine the proper computer spectacle prescription to give his or her patients. Not only can the PRIO Computer Vision Tester make the job of an eye professional easier, the device can be used as a great marketing tool, to get the attention of those suffering from the symptoms of CVS.

Works Cited and Consulted

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