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Abstract

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NEARPOINT LENS THERAPY AND THE RELIEF OF ASTHENOPIC SYMPTOMS IN VDT OPERATORS

A

Thesis

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ABSTRACT

The widespread use of VDT's and information processing systems in office settings has led to numerous complaints of eyestrain and headaches among their operators. These symptoms suggest to the eye care practitioner that the visual system is under stress. It was hypothesized that a nearpoint lens therapy would relieve these symptoms. A particular method of binocular refraction and case analysis developed by C. Michael Smith, O.D., was used to determine a nearpoint spectacle prescription. Four case studies are presented of VDT operators whose symptoms of eyestrain and headache were relieved through the use of this nearpoint lens therapy.

With recent advances in computer technology, there has been widespread and rapid introduction into the office setting of microimage and information processing systems. Most of these systems make use of some type of video display screen. The introduction of these visual display terminals (VDT's) into the work place has created new visual tasks for the operators and complaints of eyestrain are frequent.[1]

Several studies have investigated the widespread complaints among operators of VDT's, and have revealed eyestrain as a very common problem.[2, 3, 4] The symptoms typically described include burning eyes, watery eyes, double vision, pulling sensations, twitching of eye muscles, eye soreness, and general discomfort. The one most common problem reported is a chronic, dull, frontal headache.[5] These symptoms suggest to the eye care practitioner that the visual system is under stress, and the National Institute for Occupational Safety (NIOSH) ". . . is convinced that there are acute visual problems and high stress levels associated with VDT use."[6]

The use of VDT's for extended periods has been shown to be associated with complaints of headache and eyestrain. This report will attempt to establish that VDT's represent a potential source of nearpoint visual stress to its operators, and that the resulting symptoms are often due to an imbalance in the convergent and accommodative postures of the individual user. We will also attempt to show that when this imbalance does exist, the symptoms of headache and eyestrain can be alleviated through the use of a nearpoint lens therapy. Four case studies will be presented of VDT operators whose symptoms were relieved through the use of a nearpoint spectacle prescription. A particular method of binocular refraction and case analysis developed by C. Michael Smith, O.D., was used in the case studies to determine the nearpoint prescription. This method of refraction was specifically designed to investigate the balance between accommodation and convergence, especially in the patient complaining of headaches and eyestrain.

Asthenopia/Visual Headaches

Eyestrain is a concept which has not been adequately defined. In general, "Eyestrain (asthenopia) includes any complaint involving a feeling of fatigue, discomfort, or pain localized in or near the eyes or thought to be associated with the use of the eyes."[7] In this paper the term "asthenopia" will be used as a synonym for eyestrain. Asthenopia can manifest itself as various symptoms, including burning eyes, watery eyes, photophobia, pulling sensations, pressure, double vision, and general discomfort, i.e., the same complaints common to VDT operators. Commonly associated with asthenopia are what Smith describes as "vision performance headaches."[8] An important characteristic of these headaches is that they generally accompany prolonged use of the eyes (especially at near distances), and the person experiencing them is reasonably convinced that the headache is caused by a visual problem.[7]

There are many types and causes of headaches, but generally a good case history and thorough visual examination will uncover the underlying cause.[9] A vision performance headache can often have vague symptoms and mimic other types of headaches, but a general pattern is usually evident.[7, 8] The headaches are often experienced on and off for months or years, and the origin of the problem can often be traced to a change in jobs or other changes in the patient's visual requirements. Vision performance headaches tend to be of "medium" intensity and to be "dull" in character (as opposed to sharp or boring) and are located in the eyebrow (frontal) and/or temple areas. The onset and frequency are dependent on a specific visual task (usually involving near work) with the headaches often beginning around 30 to 60 minutes after starting the task. Symptoms of asthenopia generally precede the actual headache. The headache usually lasts for an hour after termination of near work, but may last several hours or even until the next day.

There are several underlying causes of asthenopia and vision performance headaches, including uncorrected hyperopia and astigmatism, and various binocular vision anomalies.[7, 8] These vision disorders create a condition of visual stress when left uncorrected, especially when working for prolonged periods at a close distance. It is this stress which eventually leads to complaints of asthenopia and headaches.

The symptoms of eyestrain and headaches described by VDT operators correlate well with the traditional concepts of asthenopia and visually related headaches. The prevalence of these problems with those who work with VDT's for extended periods suggests that there is some factor or factors involved which predisposes their users to visual stress.

VDT's and Visual Stress

It is a basic philosophy of functional optometry that the nearpoint vision demands placed upon children and adults today constitute a culturally (as opposed to biologically) imposed, socially compulsive task, for which we are not biologically suited.[10] There has not been sufficient time for evolutionary change to take place to meet these artificial demands adequately, and as a consequence, many individuals develop compensatory changes in their visual system. Among the compensatory changes associated with prolonged near work is the occurrence of eyestrain and headaches.[11] An example of a biologically unacceptable nearpoint task is reading, which is relatively recent to culture and imposes stresses of containment and of information processing through symbols in a flat, two-dimensional plane.[12] Reading requires steady fixations, limited forms of eye movement, predominate macular vision, and high degrees of visual acuity, demands which are conducive to visual fatigue.[13] VDT's represent a similar, and probably more demanding, nearpoint visual task to its user.

There are several factors peculiar to VDT operation that are likely causes of visual discomfort. These include: reflections on the display screen and discomfort glare, poor illumination quality within the display unit, poor character design and flicker effect of the light source, the focusing capability of the equipment, inappropriate working distances, and poor seating not allowing for comfortable and efficient posture.[1, 4] A significant cause of visual discomfort is glare reflected from windows onto the VDT screen. The radiation emitted from VDT's has been a cause for concern, but NIOSH studies have demonstrated that VDT's do not present a radiation hazard to employees working at or near a terminal.[3]

Other psychological and social factors can add to the stressful conditions for the VDT operator.[4] Often the introduction of computer technology involves a change in job routine which can be stressful and lead to complaints of eyestrain. VDT's often require persistent and intensive work, and general fatigue and tension can result from a demanding work load. Long periods of duty performing the same task can lead to monotony and boredom.

The above factors indicate the complexity in identifying the source of visual stress in the individual user. These other sources of visual discomfort and stress must be taken into account by the eye care practitioner when dealing with users of VDT's complaining of headache and eyestrain. However, it is our contention that even under optimal conditions, the viewing of a video display screen represents a potentially stressful condition to the visual system.

One source of problems is the difficulty in maintaining a clear focus on the characters displayed on the screen. Discrete elements (dots) making up the generated characters, blurred characters resulting from turning the brightness up to increase the contrast on a well lit display, the instability of the image from poor voltage stabilization in a commercial environment, and veiling reflections in the display, all lead to a stimulus to accommodation which is difficult for the user to focus clearly.[5] Studies using laser optometers to measure the accommodative posture of VDT operators indicate that the prolonged close work leads to a definite increase in the dark focus (or resting focus) of accommodation, with an associated increase in night myopia.[2] Subjects engaged in a visual search task on microfiche and hard copy displays assumed an accommodative posture intermediate between that of the display and their own dark focus of accommodation. "In addition, most observers did not achieve a stable accommodative state during a display viewing until several minutes into the task."[14] We hypothesize that this fluctuation in accommodation and the resulting imbalance in convergent and accommodative postures is the origin of the asthenopia and headache syndrome in many VDT users.

The visual environment for VDT work may be less than ideal, and its operators will often be required to perform more intensive work than conventional paper work. "An uncorrected refractive error, a convergence insufficiency, or binocular imbalance may therefore cause difficulty with VDT work when they may not exist under less demanding circumstances."[4] The VDT thus represents a visual environment conducive to visual stress, particularly in its manifestation of a binocular imbalance in its operators. As a result, headaches and asthenopia are common complaints. However, this binocular imbalance lends itself readily to nearpoint lens therapy, with an intended relief of symptoms.

Nearpoint Lens Therapy

Because of the prevalence of visual problems, NIOSH recommends mandatory vision testing for VDT operators. "In addition, the high visual demands of VDT work tasks define a requirement for

MB Binocular Refraction/Interaction Analysis

Smith has designed a method of binocular refraction and case analysis to determine the appropriate nearpoint lens power necessary to balance the accommodative and convergent systems over a range of distances.[8, 15] Binocular refraction has several advantages over traditional monocular testing, allowing independent testing of each eye while fusion is maintained. Improved accuracy of refraction, improved control of motor activity (accommodation, convergence, and pupil size), and improved patient comfort have been reported as benefits of this type of refraction.[15, 16, 17, 18] The system designed by Smith is a modification of the Humphriss Immediate Contrast (HIC) method of refraction, in which a plus fogging lens is used to suspend foveal fusion in the eye not being tested.[16, 17] In this way monocular testing, i.e., the fovea of one eye only, is conducted while binocular fusion is maintained through peripheral fusion cues. The reliability of this method of binocular refraction has been shown to compare favorably with other monocular and binocular testing procedures.[15]

Smith has named the method the MB refraction system. MB indicating monocular testing is done under binocular conditions. Humphriss originally used a + 0.75 Diopter fogging lens, while Smith has chosen a + 1.00 Diopter fogging lens to increase foveal suspension. The additional amount of plus carries the risk of making binocular vision unstable, so peripheral fusion cues in the test targets are important (see Figure 1). The MB binocular refraction is designed for nonpresbyopes (ages 10 to 35). The refraction places an emphasis on recovery values, e.g., 20/30 recovery balance, to determine the appropriate starting point for a + 1.00 Diopters fog, and also on repeated testing during phorias and binocular cross cylinder tests to obtain stable and accurate endpoints. The testing sequence and method for determining a spectacle prescription is shown below.

Testing Sequence	Testing Distance	OEP/MB Term
1) Static Retinoscopy	6m	4
* 2) Binocular Negative Relative Accommodation	40cm	21 BMB
* 3) Binocular Near Cylinder	40cm	BNC
* 4) Binocular Negative Relative Accommodation w/16 BI	40cm	21BMB/16 BI
** 5) Near Phoria through 21BMB	40cm	21 phoria
** 6) Binocular Crossed Cylinder w/16 BI	40cm	14B/16 BI
** 7) Binocular Crossed Cylinder	40cm	14B
** 8) Binocular Crossed Cylinder w/9 BO	40cm	14B/9 BO
** 9) Binocular Crossed Cylinder w/16 BO	40cm	14B/16 BO
* 10) Subjective Binocular Bichrome Test	6m	RG MB
* 11) Binocular Far Cylinder	6m	BFC
* 12) 20/30 MB Recovery Balance	6m	20/30 MB Bal
* 13) 20/20 MB Blur-Out Balance	6m	20/20 MB Bal
14) Maximum Plus to Best Visual Acuity	6m	7A
15) Subjective to Best Visual Acuity	6m	SBVA
16) Far Phoria through 7A	6m	8
** 17) Near Phoria through 7A	40cm	13B
** 18) Near Photia through 7A w/ -1.50 D.	40cm	13B/-1.50
** 19) Near Phoria through 7A w/ -2.50 D.	40cm	13B/-2.50

* Tests using the MB conditions (monocular plus fog)
** Critical Tests Used in Interaction Analysis

Rx Values

	Far	Near
Maximum Plus Sphere	7A	Interaction Analysis
Maximum Minus Sphere	SBVA	Interaction Analysis
Cylinder	Binocular Far Cylinder	Binocular Near Cylinder
Anisometropia	20/20 Blur-Out Balance	21B MB

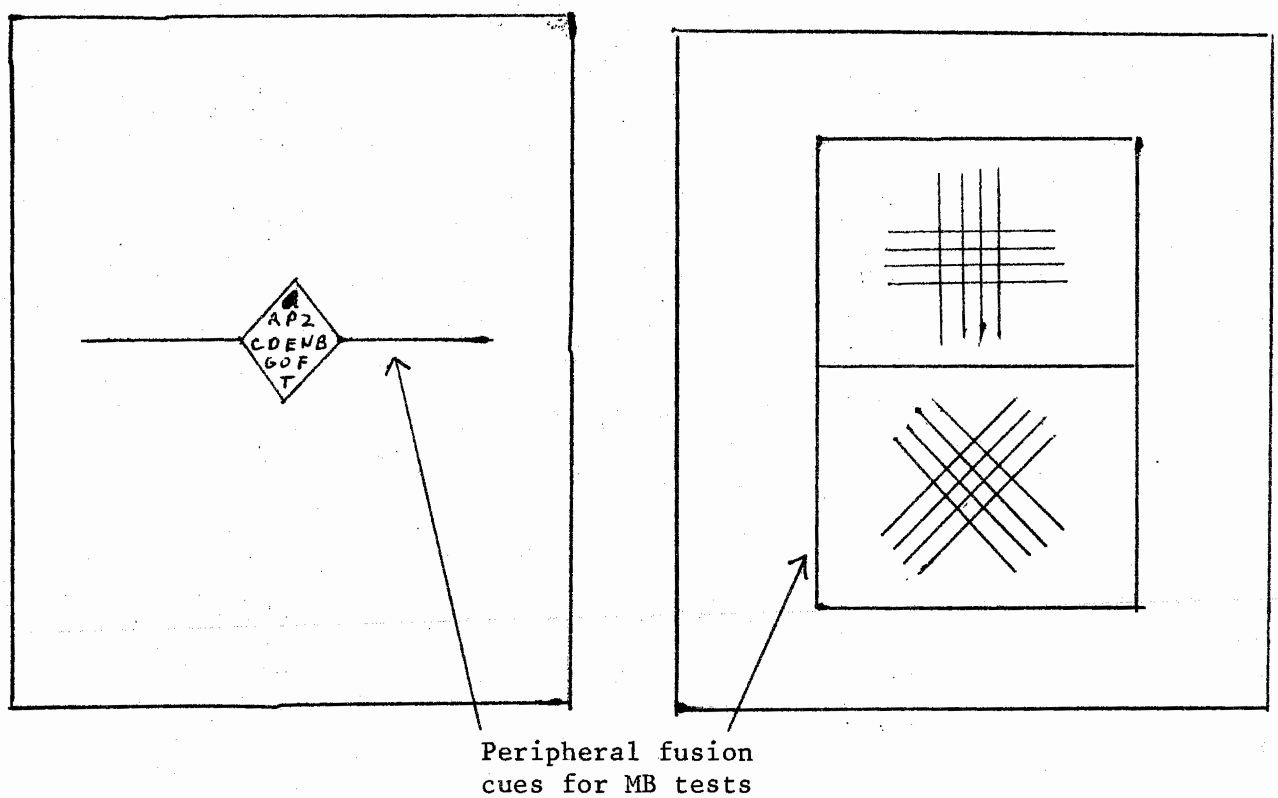
A representation of nearpoint test targets are shown in Figure 1.

Figure 1

Nearpoint Test Targets

Accommodative Control for Convergence Testing (near phorias and 21B MB)

Convergence Control for Accommodative Testing (crossed cylinder tests for binocular near cylinder)



The findings obtained from this refraction are used to analyze the interaction between accommodation and convergence, hence the term "interaction analysis". The basic assumption behind this method of refraction and analysis is that it is clinically practical to use optical stimulation to simulate various visual postures experienced in the environment, i.e., lenses and prisms are used to set and control the accommodative and convergent postures. For example, fusion through a 9 BO prism of a target at 40 cm. simulates a convergence posture of 25 cm. (or 4 MA), whereas clear vision of a target at 40 cm. through a -1.50 Diopter sphere over the 7A finding simulates an accommodative posture of 25 cm. (or 4 D.). A binocular crossed cylinder test at 40 cm. (14B) through a 9 BO prism will then measure the accommodative posture with the convergence posture 'set' at 25 cm. Similarly, a phoria at 40 cm. (13B) through a -1.50 D. sphere over 7A will measure the convergence posture with the accommodative posture 'set' at 25 cm.

All findings used in interaction analysis are done at 40 cm. to hold tonic and proximal effects constant. The table below summarizes the tests used in interaction analysis, and at what level of stimulation each test represents.

	Level of Stimulation	Measure of Convergence Posture	Measure of Acc. Posture
Posture 1	infinity	21 phoria	14B/16BI
Posture 2 (standard nearpoint)	40cm(2.5 MA)	13B	14B
Posture 3 (hyper-nearpoint)	25cm(4.0 MA)	13B/-1.50	14B/9BO
Posture 4 (stress-nearpoint)	20cm(5.0 MA)	13B/-2.50	14B/16BO

A reciprocal testing matrix is thus established, providing a simple comparison of accommodative and convergent postures. Converting all of the phoria findings from prism diopters to meter angles (MA = prism/6) gives equivalent units for comparison.

Each of the above four postures has a spherical lens value which will balance accommodation and convergence for that particular level of stimulation. To calculate this lens value, a sign convention is needed. For convergence postures, a positive value is assigned to an esophoria, and a negative value to an exophoria finding. Accommodation behind the plane of regard (net plus over 7A) is given a positive value, and accommodative postures inside the plane (net minus over 7A) is given a negative value.

The spherical lens which will balance accommodation and convergence at 40 cm. (Posture 2) will then be the average of the convergence posture at 40 cm. (13B in MA) and the accommodative posture at 40 cm. (14B in Diopters). If net findings are used in the calculation, a net add over 7A will be obtained as the balancing lens value. Similar lens values can be found for the other postures and levels of stimulation. The lens value for Postures 2 through the stress posture defines a "treatment envelope", indicating the lens power over 7A that is needed at these near distances to balance accommodation and convergence.

The behavior of the interaction of accommodation and convergence from one level of stimulation to another can also be calculated. If the convergence posture "moves in" at a greater rate than the accommodative posture, it is considered to be (arbitrarily) a positive discoordination. If the accommodative system is moving in faster than convergence, a negative discoordination is assigned.

Smith calculates two of these interactions in his analysis. Interaction 1 equals the average of the change in convergence posture from infinity to 40 cm. (21 phoria to 13B) and the change in accommodative posture from infinity to 40 cm. (14B/16BI to 14B). A positive value is assigned to the change in convergence posture if less exophoria (or more esophoria) is shown at the closer distance. For example, a change from 12^{Δ} exo at infinity to 6^{Δ} exo at 40 cm. will equal a $+6^{\Delta}$ or a +1 MA change. Similarly, a positive value would be assigned to the change in accommodation from infinity to 40 cm. if more plus is accepted at the 40 cm. level of stimulation.

Interaction 2 is calculated in the same way, using the changes in convergent and accommodative postures from the 40 cm. to the 25 cm. level of stimulation. If the calculated interaction is a positive value, it indicates that the convergent system is "moving in" faster than the accommodative system. To help clarify these calculations, a sample analysis is given below using test results from one of the four case studies to be presented.

Subject: ML

7A OD -2.00 -0.75 x 48
OS -1.50 -0.75 x 143

21 phoria = 10 XO = -1.67 MA		(net sphere findings OD)	
		14B/16BI	= +2.50 D.
13B = 4 XO = -0.67 MA		14B	= +2.00 D.
13B/-1.50 = 3 eso = +0.50 MA		14B/9BO	= +1.25 D.
13B/-2.50 = 7 eso = +1.12 MA		14B/16BO	= +0.50 D.

$$P_1 = \frac{21ph + 14B/16BI}{2} = \frac{-1.67 + 2.50}{2} = +0.37$$

$$P_2 = \frac{13B + 14B}{2} = \frac{-0.67 + 2.00}{2} = +0.62$$

$$P_3 = \frac{13B/-1.50 + 14B/9BO}{2} = \frac{+0.50 + 1.25}{2} = +0.87$$

$$P_{stress} = \frac{13B/-2.50 + 14B/16BO}{2} = \frac{+1.12 + 0.50}{2} = +0.87$$

(P_2, P_3, P_{stress}:) Treatment Envelope* (net plus over 7A to balance)

$$\text{Interaction 1} = \frac{\Delta\,(\text{21ph to 13B}) + \Delta\,(\text{14B/16BI to 14B})}{2} = \frac{+1.00 - 0.50}{2} = +0.25$$

$$\text{Interaction 2} = \frac{\Delta\,(\text{13B to 13B/}-1.50) + \Delta\,(\text{14B to 14B/9BO})}{2} = \frac{+1.12 - 0.75}{2}$$

$$= +0.12$$

Additionally: $P_2 = P_1 + I_1 = +0.37 + 0.25 = +0.62$

$P_3 = P_2 + I_2 = +0.62 + 0.12 = +0.87$

*All findings rounded up to the nearest 0.25 D.

When interaction analysis indicates an imbalance between accommodation and convergence, the treatment envelope will give the range of net lens values over 7A that is needed at near to restore the balance. The actual amount of the near add to be prescribed is based on the patient's working distance at which symptoms develop and the values within the treatment envelope. At least $\pm$ 0.50 D. over 7A is considered clinically significant to warrant a possible nearpoint lens prescription. Most cases of imbalance will indicate a need for a plus add at near, and either plus or base out prism or a combination can be used. Large amounts of prism are avoided and only used when a large imbalance exists.

The MB binocular refraction and interaction analysis requires a binocular patient for successful testing: a traditional monocular refraction is needed for strabismics, amblyopes, suppressors, etc. There are other limitations to the system as well. For example, a patient with a convergence insufficiency (with high exophoria at near) may not show an unbalanced system at near, but will often suffer complaints of asthenopia and headaches with prolonged nearpoint tasks. Visual training would be the strategy of choice in cases such as this.

Results

The following tables consist of the MB binocular refraction findings of each subject used in this study. Interaction analysis results from these findings and the lens values prescribed for near work are also included.

Results shown are dominant eye findings (anisometropia in Rx is consistent with anisometropia found in the 7A). Cylinder values in the prescription are also consistent with the 7A cylindrical values.

Subject JP

Habitual Farpoint Prescription: OD -0.37 -0.75 x 67
OS -0.50 -0.50 x 62

Authors' Farpoint Prescription: OD -0.25 -0.75 x 65
OS -0.25 -0.25 x 60

Tests Used and Subject Findings:

4	-0.75	20/30 MB Bal.	+0.50
21BMB	+3.00	20/20 MB Bal.	+0.50
21BMB/16BI	+2.75	7A	-0.25
21 phoria	12 XO	SBVA	-0.50
14B/16BI	+2.25	8	4 eso
14B	+1.00	13B	12 eso
14B/9BO	pl	13B/-1.50	14 eso
14B/16BO	-0.50	13B-2.50	22 eso
RG MB	-0.50		

Interaction Analysis:

P_1 +0.37 P_3 +1.25

P_2 +1.62 P_4 +1.75

Nearpoint Prescription:

+1.50 Diopter net plus over the farpoint prescription.

Subject ML

Habitual Farpoint Prescription: OD -2.00 -0.75 x 47
OS -1.50 -0.75 x 147

Authors' Farpoint Prescription: OD -2.00 -0.75 x 48
OS -1.50 -0.75 x 143

Tests Used and Subject Findings:

4	-2.00	20/30 MB Bal.	-1.50
21BMB	+1.25	20/20 MB Bal.	-2.00
21BMB/16BI	+1.25	7A	-2.00
21 phoria	10 XO	SBVA	-2.25
14B/16BI	+0.50	8	1 eso
14B	pl	13B	4 XO
14B/9BO	-0.75	13B/-1.50	3 eso
14B/16BO	-1.50	13B/-2.50	7 eso
RG MB	-1.00		

Interaction Analysis:

P_1 +0.37 P_3 +0.87

P_2 +0.62 P_4 +0.87

Nearpoint Prescription:

+1.00 Diopter net plus over the farpoint prescription.

Subject GH

Habitual Farpoint Prescription: OD -1.00 sphere
OS -1.00 sphere

Authors' Farpoint Prescription: OD -0.50 -0.50 x 105
OS -0.50 -0.25 x 86

Tests Used and Subject Findings:

4	-0.75	20/30 MB Bal.	+0.25
21BMB	+2.50	20/20 MB Bal.	+0.25
21BMB/16BI	+2.50	7A	-0.25
21 phoria	8 XO	SBVA	-0.75
14B/16BI	+1.50	8	4 eso
14B	+0.50	13B	3 XO
14B/9BO	pl	13B/-1.50	4 eso
14B/16BO	-0.50	13B/-2.50	8 eso
RG MB	-0.25		

Interaction Analysis:

P_1 +0.37 P_3 +0.62

P_2 +0.25 P_4 +0.62

Nearpoint Prescription:

+0.75 Diopter net plus over the farpoint prescription.

Subject BA

Habitual Farpoint Prescription: OD plano
OS plano

Authors' Farpoint Prescription: OD +0.50 sphere
OS +0.75 -0.50 x 005

Tests Used and Subject Findings:

4	+0.50	20/30 MB Bal.	+1.50
21BMB	+2.50	20/20 MB Bal.	+1.50
21BMB/16BI	+4.00	7A	+1.00
21 phoria	12 XO	SBVA	+0.50
14B/16BI	+2.50	8	2 eso
14B	+2.00	13B	3 eso
14B/9BO	+1.25	13B/-1.50	10 eso
14B/16BO	+0.75	13B/-2.50	15 eso
RG MB	+0.75		

Interaction Analysis:

P_1 pl P_3 +1.25

P_2 +1.00 P_4 +1.37

Nearpoint Prescription:

+1.00 Diopter net plus over the farpoint prescription.

Discussion

In support of our theories on the effectiveness of nearpoint lens therapy in the relief of asthenopia and headaches in VDT operators, four case studies are presented. Each subject operates a VDT in their employment and suffered complaints of eyestrain and/or headaches. A nearpoint lens prescription was given to each subject to wear while operating a VDT or while doing other near-work, and the effectiveness of this therapy was then evaluated after six weeks.

A survey was developed to evaluate the visual performance of VDT operators and to identify the possible need for nearpoint lens therapy (Appendix A). The survey was designed to establish whether an eyestrain and/or headache problem really existed, and whether these symptoms were related to the operation of VDT's. Subjects were asked to subjectively rate the intensity of their symptoms on an ordinal scale from 0 to 10 ("0" indicating symptoms not bothersome, "10" symptoms unbearable). Only non-presbyopes (under 35 years) were considered as potential subjects. The important aspects of this initial survey are summarized in Table 1.

Those subjects judged to be potential candidates for lens therapy based on the initial survey were given a complete optometric examination at Pacific University College of Optometry, including the MB binocular refraction. Subjects were prescribed a nearpoint lens only if there was not a significant change in their habitual farpoint prescription. A significant change was considered to be more than a 0.50 D. change in sphere, cylinder, or anisometropia, or a change in cylinder axis of 5 degrees. Also considered to be an acceptable condition was less than 1.00 D. of uncorrected hyperopia. These variances between the habitual farpoint prescription and the authors' farpoint prescription were kept to a minimum to minimize any change in symptomatology occurring as a result of a prescription change at the farpoint. This keeps the farpoint prescription constant, with the major change in the patient's prescription (from the habitual) being additional plus for nearwork. Any pathology was ruled out as a possible cause of symptoms. All participating subjects gave permission to be included in this study by signing a human subject release form (Appendix B).

The nearpoint prescriptions dispensed were all single vision lenses with no tints. Three subjects were prescribed plastic lenses and one with glass lenses. The value of the nearpoint lens power was based on interaction analysis (either Posture 2 or Posture 3), all four subjects receiving net plus over their distance prescription. Patients were instructed that their glasses were designed to be worn only for nearpoint tasks, specifically when working at a VDT, and would cause blurred vision at distance. Subjects were also told that there would be an adaptation period with their glasses, the first few days of wear possibly being uncomfortable.

After six weeks of wearing the nearpoint prescription, subjects were given a second survey to rate the success of lens therapy in relieving symptoms of headache and asthenopia (Appendix C). Table 2 summarizes the results of the second survey and compares the results with the initial survey. All four subjects reported a total lack of eyestrain and headaches associated with VDT work after six weeks of lens therapy. All subjects felt that their glasses were effective in relieving these symptoms.

The case studies reported suggest that nearpoint lens therapy can be successful in alleviating the visual stress and its accompanying symptoms associated with VDT operation. Our subject population is small, and no control group is offered to investigate the Hawthorne effect. It may be that prescribing plano lenses would have been effective in relieving eyestrain and headaches in these patients. However, all subjects have experienced symptoms with VDT work on a nearly daily basis for over a year, and it is questionable that the Hawthorne effect can account for the total lack of symptoms after six weeks of lens wear.

The importance of this report lies in the theoretical basis it offers for the origin of visual stress in VDT operators, and the possible relief of that stress through nearpoint lens therapy. There are many possible causes of visual stress with VDT work, and these need to be considered before a nearpoint prescription is suggested. We contend that even when these other factors are taken into account, there will still be a significant number of VDT operators who will suffer complaints of asthenopia and headaches. VDT's constitute an unnatural visual environment which is conducive to visual stress, a stress resulting from an imbalance in the convergence and accommodative systems. A stress-relieving lens designed to balance the visual system at the nearpoint can relieve the accompanying symptoms reported by many of the nearly seven million workers using VDT's.

Table 1

Summary of Survey #1

Subject	BA	GH	ML	JP
Age	32	30	28	31
Sex	F	F	F	M
Hrs./Day at VDT	8	8	4-5	4-5
Eyestrain w/ VDT Work?	yes	yes	yes	yes
Rating of Eyestrain	2	5-10*	3	3
Ha's w/ VDT Work?	yes	yes	yes	yes
Rating of Ha's	7	5-10*	7	6
How long w/ symptoms?	Several yrs.	5½ yrs.	1 yr.	1 yr.
Present Rx: Far	no	yes	yes	yes
at VDT	no	no	yes	yes

*Headaches/eyestrain rated at 10 by end of work day.

Table 2

Subject	BA	GH	ML	JP
<u>SURVEY #1</u>				
Rating of eyestrain	2	5-10	3	3
Rating of Ha's	7	5-10	7	6
<u>SURVEY #2</u>				
Wearing time of Rx at VDT?	50%	60-80%	50%	60-80%
Eyestrain w/ VDT Work?	no	no	no	no
Ha's w/ VDT work?	no	no	no	no
Rx judged effective in relieving symptoms?	yes	yes	yes	yes

Appendix A

Sample Survey #1

The following questions are intended to evaluate your visual performance while operating a video display terminal. All information collected in these surveys will be used solely for the purpose of a research project and will remain strictly confidential.

Name ______________________ Date of Birth ______ Sex ___

Address ____

Phone (Work) ____________________ (Home) ____________________

1. How long have you been employed in a job which regularly makes use of a video display terminal (VDT)? ____________________
years/months

2. What is the total amount of time that you spend working at a VDT on an average workday? ____________________
hours

3. Do you often feel "eye discomfort" (fatigue, pulling, ache, tightness, redness, pressure) when working at a VDT? YES NO

4. a. Do you often get "headaches" during or after working at a VDT? YES NO

   b. Do you feel these headaches are related to your eyes? YES NO

5. If your answer to questions 3 or 4 was "yes"; how long after you begin work at a VDT does it take for eye discomfort to begin?
____
hours/minutes

   headaches? ____________________
hours/minutes

6. If your answer to questions 3 or 4 was "yes"; indicate how bothersome these are to you.

eye discomfort	0	1	2	3	4	5	6	7	8	9	10
headaches	0	1	2	3	4	5	6	7	8	9	10
	none							unbearable			

7. How long have you had these symptoms? ____________________
years/months

8. Do the words on the VDT often seem to double or split when you read? YES NO

9. Do you often have difficulty maintaining clear vision while viewing a VDT? YES NO

10. Do you feel that you must use an excessive amount of effort to change your focus back and forth between a VDT and a distant object? YES NO

11. Do you presently wear a spectacle prescription? YES NO

If yes, circle appropriately: glasses/contact lenses
full time/part time
single vision/bifocal
far only/near only

12. How long have you worn your present prescription? ____________
years/months

13. When was your last visual examination? ____________________
month/year

14. Do you wear your prescription while working at a VDT?
YES NO

Appendix B

Sample Human Subject Release Form

1. Institution:

   A. Title of Project: The effects of Nearpoint Lens Therapy in the relief of Asthenopic symptoms in Computer Display Screen Operators.

   B. Principal Investigators: Bruce Beaulaurier, John Chrisagis, Dave Hansen

   C. Advisor: Richard Septon, O.D.

   D. Location: Pacific University College of Optometry, Forest Grove

   E. Date: 1981

2. Description of the Project:

   This project is designed to monitor the effects of a near lens therapy used to reduce asthenopia and headaches in computer display screen operators.

3. Description of Risks:

   There is the possibility of some adaptation period at the beginning of the lens wear. A blur at near may be experienced, but should subside as the lenses are worn at work. It must be noted that these spectacles are to be used for near work only and nothing else. Driving with the correction we give you is not a part of this study and should not be undertaken.

4. Description of Benefits:

   Possible relief of eyestrain and headaches associated with the use of computer display screens. This could benefit the computer oriented industries by letting them know what can be done for symptomatic employees.

5. Compensation and Medical Care:

   If you are injured 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 the experiment. All reasonable care will be used to prevent injury.

6. Offer to Answer Any Inquiries:

   The experimenters will be happy to answer any questions that you may have at any time during the course of this study.

7. Freedom to Withdraw:

   You are free to withdraw your consent and to discontinue participation in this project or activity at any time without prejudice to you.

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

Signed ______________________________ Date ______________

Address ______________________________ Phone ______________

____

Appendix C

Sample Survey #2

The following questions are intended to evaluate your visual performance while operating a visual display terminal. All information collected in these surveys will be used solely for the purpose of a research project and will remain strictly confidential.

Name ______________________________ Date __________

The questions below comprise the second survey (post-survey) in our project. They pertain to your use of the spectacle correction we prescribed; and the subsequent results.

1. Since receiving your correction, what percent of your time at a VDT did you wear your spectacles?

   a. 80-100% c. 50%
   b. 60-79% d. less than 50%

2. Do you still get headaches while wearing your spectacles at work?
   YES NO

3. If your answer to question 2 was yes, please rate how bothersome these headaches are to you.

   0 1 2 3 4 5 6 7 8 9 10

4. Do you still get eyestrain while wearing your spectacles at work?
   YES NO

5. If your answer to question 4 was yes, please rate how bothersome this eyestrain is to you.

   0 1 2 3 4 5 6 7 8 9 10

6. Do you feel these glasses have been effective at relieving some or all of the symptoms you had before this study began?
   YES NO

Thank you for your cooperation in this study. Hopefully we will have learned something which may benefit present and future VDT users. We would also appreciate any comments you may have concerning this study in general or the advantages/disadvantages of wearing these spectacles.

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