Nearpoint visual stress: clinical implications

Martin H. Birnbaum, O.D.

Abstract: A physiological model of nearpoint stress, based on autonomic arousal, was presented in a companion paper. This paper deals with clinical implications of the nearpoint stress model, including clinical manifestations, adaptive responses to nearpoint stress, and management of nearpoint stress-induced vision disorders.

Key words: nearpoint visual stress, stress, stress-induced illness, myopia, accommodative insufficiency, autonomic arousal, overconvergence, vision training

Introduction

The nearpoint stress model holds that many vision disorders develop as a result of extensive exposure to the nearpoint demands of our society. Task demands for attention and information-processing activate autonomic reflexes which lead to a tendency for convergence to localize closer than accommodation. Autonomic activation is exacerbated by the high stress levels pervasive in our society. The physiology underlying autonomic activation and resultant overconvergence is discussed in a companion paper. Such a comprehensive model is different to test conclusively given the presence of so many variables. However, much clinical evidence supports the model, and clinical experience suggests that the model provides considerable insight into the interpretation of optometric findings; the development of vision disorders; case analysis; and the treatment and prevention of nearpoint stress-induced vision disorders.

The purpose of this paper is to summarize and review clinical aspects of the nearpoint stress model, including clinical manifestations of overconvergence, adaptations to nearpoint stress, and implications for case analysis, diagnosis and management, as well as to present clinical evidence and report clinical experience in support of the model.

Clinical manifestations of overconvergence

Traditionally, the near phoria has been viewed as a relatively fixed, stable entity. However, many individuals exhibit a progressive eso shift associated with intensity and sustained attention. This eso shift may be explained on the basis of a physiological model. Autonomic arousal increases with heightened attention and mental effort, producing a shift toward farpoint, with consequent increase in accommodative effort required to achieve conjugate focus at near, and associated progressive overconvergence.

Stewart reported an increase in nearpoint esophoria following sustained binocular effort in subjects who spent one-half hour viewing stereograms. Vaegan reported an increase in esophoria between first glance and 15 seconds later as well-known clinical consequence of continued inspection of the Maddox wing. A similar eso shift is often noted when the near phoria finding is taken before and after a brief period of reading.

During cheiroscopic tracing, many patients exhibit a progressive eso shift as the tracing proceeds. This shift is commonly found in exophores as well as esophores. Progressive eso shift is rarely observed, except in divergent strabismus. The eso shift commonly observed during cheiroscopic tracing apparently occurs as a result of autonomic arousal associated with vigilant attention and intense application.

A progressive shift towards increased esophoria with sustained attention is frequently observed when the near phoria test is repeated several times. It is not unusual to find an eso shift of 4° to 6° or more as several measures are obtained in rapid succession, taken from the base in side to minimize bias towards esophoria. Occasional patients show a progressive exo shift, suggestive of an inability to sustain accommodation through time.
present under habitual near working conditions may be much greater than that suggested by the dissociated near phoria test. The associated phoria is often less exo or more eso than the dissociated phoria. Schor suggests that this increased eso under associated (fused) conditions results from the interaction between accommodative convergence and convergence accommodation. This interaction may be exacerbated, with consequent increase in overconvergence tendency, as a result of autonomic arousal, since sympathetic activation creates a mild cycloplegic effect which would be expected to generate an increase in the AC/A ratio.

Both clinical and research evidence thus stand in conflict with the traditional notion of a fixed near phoria. This evidence underscores the inadequacy of case analysis systems which seek to define comfort and visual efficiency in terms of the relationship between supposed fusional demand (near phoria) and reserves (prism vergence measures). The near phoria test measures oculomotor balance at a given instant in time, under conditions of relatively minimal demand. Tasks which impose greater attentional and information-processing demands may generate increased overconvergence. Even patients manifesting orthophoria or low esophoria on a dissociated near phoria test often show overconvergence during the intense nearpoint demands common to our society. The significance of a near esophoria (or esophoria less than the expected) measured under dissociated conditions during the routine examination lies not in the fusional demand imposed by the phoria, but rather in the high overconvergence on more intense, prolonged tasks implied by such a finding.

Skeffington postulated that a nearpoint esophoria of at least 6^A is necessary to serve as a buffer against overconvergence. Studies have documented that low esophoria at near is an expected, normative finding. Haines reported a mean near phoria of 5^A exo in a sample of 500 asymptomatic visually efficient individuals. Shepard and Morgan did not eliminate symptomatic or visually inefficient individuals, and found mean near phoria measures of 5^A and 3^A exo respectively.

Clinical experience indicates that a 4–6 esophoria is indeed necessary to buffer the effect of nearpoint stress. A tendency towards overconvergence is, in this author's experience, the earliest clinical sign of a developing nearpoint stress-induced visual problem. Overconvergence may manifest as a nearpoint esophoria or as a progressive eso shift on cheiroscopic tracing or when repetitive near phoria measures are taken consecutively.

The nearpoint phoria measures itself, as routinely taken in the optometric examination, is an extremely sensitive, bellweather finding. Measurement of esophoria, orthophoria, or even a few prism diop ters less than the expected 5^A or 6^A esophoria is an early signal of nearpoint stress. Failure to recognize this early signal and to apply preventive measures is frequently followed by adverse adaptive change, often myopia.

Another early sign of nearpoint stress-induced vision disorder is the presence of a low positive relative accommodation (P.R.A.) finding. The P.R.A. test is a measure of flexibility between accommodation and convergence. When convergence tends to localize closer than accommodation, the patient with inadequate flexibility between these effector systems will have difficulty shifting accommodation closer than convergence, as required by the P.R.A. test. Thus, a low finding is the result of a tendency towards overconvergence, rather than a true weakness of accommodation.

A low P.R.A. finding is frequently found in adaptations to nearpoint stress. It is characteristic of accommodative insufficiency, and is common in convergence insufficiency. In my experience, a low P.R.A. finding is also commonly found in the incipient and progressive stages of myopia development, as well as in individuals who dislike and avoid nearpoint visual demands.

Adaptations to nearpoint stress

Although a tendency for convergence to localize closer than accommodation is inherent in the near work demands imposed by our society, not all individuals develop nearpoint stress-induced vision disorders. Many individuals retain adequate flexibility between accommodation and convergence; though subject to fluctuations towards esophoria during demands for concentration and mental effort, they are able to rebound and maintain homeostasis without need for adverse adaptation. These individuals tend to demonstrate the expected 5 to 6^A exophoria on the nearpoint dissociated phoria test. This "physiological" exophoria allows the individual to buffer or absorb the eso tendency associated with mental effort and attention, without manifesting overconvergence.

Individuals who are very intense tend, especially when nearwork demands are extensive, to lose the ability to rebound to restore homeostasis. Repeated exposure to stress leads to manifest overconverg-
ence. This loss of flexibility and resultant overconvergence creates a demand for increased energy expenditure, and leads to asthenopia, inability to sustain at close work, and interference with comprehension. The effector system mismatch must be resolved if nearpoint function is to be efficient. Individuals who are unable to maintain adequate flexibility between accommodation and convergence will present with discomfort and impaired performance; avoid near work in order to prevent asthenopia; or develop adaptations to resolve or reduce overconvergence. When patients are unable to adapt, or when demands are too great, the overconvergence tendency will manifest as esophoria or intermittent esotropia at near.

Asthenopic symptoms may relate to increased effort to match accommodation and convergence or, as Bartley suggests, asthenopia may occur when, as a result of visual inefficiency, the level of achievement is unsatisfactory to the individual.

Adaptability is a fundamental attribute of human behavior. Adaptation may take a variety of forms, each of which serves to facilitate nearpoint performance, yet at the same time imposes its own limitations.

Refractive anomalies, particularly myopia, and various accommodative and binocular disturbances may occur adaptively to reduce overconvergence. These vision disorders, arising as the result of altered physiology induced by stress activation, constitute a variety of stress-induced illness, one of many to which civilized man is subject.

Although all sympathetically-innervated structures are activated in response to stress, maximum activation occurs in different physiological systems for different individuals. Some individuals develop disorders in the visual system, some in other systems and organs of the body, and some develop multiple disorders.

Intense, analytical individuals tend to function under high levels of stress and may be prone to stress-induced illness. Type A behavior, a behavior pattern characterized by a strong sense of time urgency, striving for achievement, competitiveness, and aggressiveness, tends to be associated with coronary disease. Hyper-reactivity of the autonomic nervous system is a physiological concomitant of the type A behavior pattern, and may underlie the development of disease.

Since intense, analytical individuals tend to invest greater attentional energy during near work, increased sympathetic activation may be expected to generate a greater incidence of nearpoint stress-induced disorders (adaptations to nearpoint stress). Indeed, Gawron performed several physiological tests to obtain an index of autonomic activity, and reported heightened sympathetic activity in myopes as compared to hyperopes. Similar studies have not been performed on patients with binocular and accommodative disorders. However, an extensive literature links myopia and convergence insufficiency with personality and emotional factors which may underlie heightened sympathetic arousal.

Exposure to near work in our society is universal, and nearpoint stress-induced vision disorders are common. Susceptibility is determined by many factors, including extent of exposure to near work and to general stress; environmental and cultural factors related to the drive for achievement; adequacy of psychological and physiological coping mechanisms; genetic factors; personality, and cognitive/perceptual behavior style. Tight, tense individuals may exhibit reduced freedom between effector systems as well as increased sympathetic activation, and may be more susceptible to stress on both counts. The path of adaptation that is taken will depend upon the significance to the individual of the functional limitations imposed by each adaptation, as well as by environmental and genetic factors and by the degree of plasticity in the system.

Myopia as an adaptation

The idea that myopia occurs in relation to near work was introduced by Cohn, who attributed myopia to over-use of accommodation. Skeffington’s nearpoint stress model differs, viewing myopia as an attempt to resolve effector system mismatch by permitting localization of focus and alignment in the same plane.

An abundant literature documents the relationship between myopia and near work. Although it is sometimes argued that this relationship exists because myopes are better suited for close work, high academic achievement precedes the onset of myopia in most cases.

Young reported an increased incidence of myopia among Eskimos following the introduction of compulsory education. Myopia develops in many military academy and graduate students at ages well beyond the influence of growth and heredity as causative factors. Informal surveys of optometry students indicate that about one-third show myopia development or progression during the
Myopia is one of the most effective adaptations, permitting efficient, comfortable nearpoint function by reducing accommodative demand and associated overconvergence.

Accommodative insufficiency

Accommodative insufficiency, characterized by low P.R.A. and/or low amplitude of accommodation, is traditionally viewed as a weakness of accommodation, or failure to develop adequate accommodative ability. However, monocular amplitude of accommodation, even when very low, usually normalizes so rapidly during vision training as to cause wonder that the patient did not learn this skill by himself. Signs of overconvergence and a low P.R.A. finding are almost universally present as myopia develops and progresses.

Myopia is usually similar in magnitude in the two eyes. However, myopic anisometropia may develop when the maintenance of distance visual acuity holds greater value to the individual than does retention of binocular function. In myopic anisometropia, the emmetropic or slightly myopic eye is used for distance vision. The more myopic eye is used for nearpoint, reducing accommodative demand and associated overconvergence.

Because myopia impairs distance visual acuity, other adaptive paths are often taken. These are less effective at nearpoint, but preserve distance acuity. If these adaptations prove unsatisfactory, or become so as nearpoint demands increase, myopia may ultimately follow. Myopia frequently occurs when college or vocational requirements present demands for near work beyond that previously encountered.

The significance of hyperopia

Hyperopia of 0.50 to 0.75 diopters is the mean human refractive state. This low hyperopia is viewed by functionalists as a desirable refractive state; it provides a buffer in the presence of exogenous and endogenous factors which influence autonomic balance and hence the accommodative system. Emmetropia is seen not as a normal, perfect, or ideal state, but rather as reflecting a loss of this buffer, signalling the likelihood of further adaptive change, frequently into myopia.

An alternate view, consistent with these clinical observations, holds that accommodative insufficiency is a purposive inhibition of accommodative function, creating a lag of accommodation beyond the plane of regard to reduce associated overconvergence. When inhibition is sufficiently conditioned, response to minus lenses will be poor even monocularly; thus monocular amplitude is reduced. This conditioned inhibition is readily reversed via monocular accommodative rock training; in fact, in those few cases in which monocular amplitude does not normalize rapidly, neurological or psychogenic factors should be suspected.

The patient who inhibits accommodation will respond poorly to phorometric probes which require localization of accommodation closer than convergence; thus, the P.R.A. finding will be low. This low P.R.A. measure is slower to normalize, since it requires reversal of the basic nearpoint stress pattern of convergence localizing closer than accommodation.
embedding inhibition of accommodation. High hyperopia usually develops in infancy and early childhood, during the period of life when the accommodation-convergence relationship is being formed, perhaps reflecting failure to develop adequate freedom between accommodation and convergence during this period.

**Convergence insufficiency**

Convergence insufficiency, characterized by high exophoria at near, low positive fusional convergence, and receded convergence nearpoint, is traditionally attributed to weakness of convergence, or failure to develop adequate convergence skill.\(^{13,23}\)

In contrast, functionalists view the convergence insufficiency pattern as an adaptation. Low P.R.C. and receded C.N.P. findings reflect a conditioned inhibition of fusional convergence, to reduce overconvergence under habitual reading conditions.\(^{6}\)

High exophoria measured at nearpoint under dissociated conditions is viewed not as a demand upon fusional convergence, but rather as an alteration in innervational pattern, an adaptive recalibration to permit alignment under habitual fused conditions, despite the overconvergence tendency induced by intense nearpoint activity.\(^{1}\) Consistent with this concept, Ogle, Martens and Dyer reported that, when the dissociated and associated phorias differ, the associated measure is usually greater in eso, suggesting a tendency towards overconvergence under fused conditions.\(^{7}\) Saladin and Sheedy, in contrast, found a higher proportion of esophores with eso fixation disparity.\(^{40}\) Ogle's findings are more consistent with this author's clinical experience.

Esophores and intermittent exotropes often show eso fixation disparity, especially after orthoptic treatment.\(^{41}\) Although the traditional view suggests that this results from excess adaptation and overcompensation, an alternate view suggests that the eso demonstrated under binocular, fused conditions constitutes the underlying primary problem.\(^{1}\) This view is consistent with the common clinical observation that many esophores shift into eso under conditions presenting demands for sustained attention, as in cheiroscopic tracing and repetitive phoria measures.\(^{6}\)

The purposive development of high nearpoint exophoria might occur through prism adaptation, a process in which alteration in tonic vergence occurs to reduce stress on the binocular system,\(^{41}\) or through change in the accommodation-convergence relationship. Although the AC/A ratio is often described as fixed and resistant to change,\(^{42}\) evidence suggests that adaptive changes in AC/A do in fact occur when such change is required for efficient function, and when the stimulus for change is sufficiently great.\(^{43-49}\) The AC/A remains fairly stable during the pre-presbyopic years,\(^{50}\) despite increasing rigidity of the crystalline lens. The demand for increasing accommodative effort would be expected to lead to increase in the AC/A ratio; that this does not occur suggests that an adaptive process is at work.\(^{43}\) Esotropes sometimes maintain a reduced AC/A ratio following discontinuation of miotic therapy, also suggesting that adaptation has taken place.\(^{44}\) Changes in AC/A are often in uncorrected myopes during adaptation to full refractive correction.\(^{45}\) The accommodation-convergence relationship develops early in life, yet must be sufficiently flexible to allow modification in response to growth-induced increase in interpupillary distance.\(^{43}\) Adaptive change in AC/A is induced when demands on accommodative vergence are altered by optically changing the effective interocular separation.\(^{46}\) Changes in the AC/A ratio as a result of orthoptics have been reported.\(^{47,48}\) Cases demonstrating significant variation in AC/A over the years, sometimes as a consequence of refractive status change, lens application, and/or orthoptics, have been documented.\(^{49}\)

These findings all suggest that the AC/A is not as rigid and inflexible as was once thought.

Clinical observations are consistent with the concept of convergence insufficiency as a functional inhibition to reduce overconvergence. During treatment of convergence insufficiency, patients often manifest signs of overconvergence, including eso fixation disparity,\(^{51}\)
I have found that patients who inhibit accommodation and/or convergence often develop a global style of reading, with reduced awareness of detail.\(^1\)  

As binocularity weakens, high exophoria may itself interfere with binocular function and serve as a source of asthenopic symptoms.\(^2\)  

Further, Skeffington suggests that divergence excess and other varieties of exotropia may develop as the result of a spread of the innervational pattern for inhibition of convergence from near towards far.\(^1\)  

Thus, to reduce overconvergence, individuals may inhibit fusional convergence and/or inhibit accommodation to reduce associated overconvergence. So-called accommodative insufficiency and convergence insufficiency represent the result of functional inhibition, rather than true weakness of function. Accommodative and convergence insufficiency arise from the same cause, and do not represent truly different case types. Clinical differentiation is artificial and often difficult, since patients with convergence insufficiency frequently demonstrate reduced accommodative findings, and patients with accommodative insufficiency often exhibit impaired convergence function. Recovery findings show impairment earlier than break findings since fusional recovery, a jump vergence function, presents a greater demand than does the smooth vergence break measure. A low recovery finding thus indicates early impairment of binocular function; when both break and recovery findings are low, it implies that binocular function is even more fragile. Blur findings are a measure of flexibility between accommodation and convergence. Low findings indicate a lack of freedom and high likelihood of stress-induced vision disorder.\(^1\)

I have found that patients who inhibit accommodation and/or convergence often develop a global style of reading, with reduced awareness of detail. They tend to make numerous careless, small word errors, which significantly impair oral reading skills and comprehension. Weisz has demonstrated the effectiveness of accommodative training in improving accuracy of nearpoint performance in children with accommodative disorders.\(^2\) Clinically, treatment of these disorders often leads to improved oral reading and comprehension skills, as well as improved ability to sustain, with relief from asthenopia.

Avoidance and withdrawal

Many patients show constricted prism vergence and accommodative findings, yet report little asthenopia and appear asymptomatic. They commonly report, when questioned further, that they read little and do not like to read. Such patients apparently avoid reading in order to minimize asthenopia.\(^1,5\) They may have learning problems, or may achieve adequately if intelligent enough to learn with minimal reading. Such patients almost always experience asthenopia if near work demands are prolonged. They often develop myopia or experience severe asthenopia when they reach a level of academic or vocational demand at which avoidance is impossible.
Lack of interest in reading influences achievement, career selection, and interest in higher education. Vision problems which cause disinterest in school may even predispose towards juvenile delinquency and criminality.

Vision problems which limit human potential are often not treated because patients are asymptomatic. The absence of subjective asthenopic symptoms should not be interpreted to mean that problems do not exist. Treatment should be offered when functional vision disorders interfere with nearpoint efficiency and comfort, or lead to avoidance of reading, even though the latter patients, because they do not read, do not report asthenopic symptoms.

Phorias and stress reactivity

In contrast to the traditional view of phorias as ocular motor imbalances presenting fusional demands which must be overcome, the near phoria has been viewed in the context of stress reactivity. The dissociated near phoria is influenced by autonomic arousal in response to stress. Sym pathetic activation creates a mild cycloplegia effect, so that greater effort is required to accommodate, creating a tendency towards esophoria. The dissociated near phoria measure is a function of the individual’s response to stress as modified by subsequent adaptation.

The distance phoria measure may also be considered in the context of stress reactivity. The shift from nearpoint activity (with its inherent attentional demands) to distance vision involves recovery from stress. Stress reactivity consists of two phases: the response to stressor agents, mediated by the sympathetic nervous system, and the recovery from stress, a homeostatic restoration of energy and equilibrium mediated by the parasympathetic system. Some individuals exhibit physiological recovery from stress which is atypical, i.e., recovery is either inadequate (insufficient or extremely slow) or excessive, leading to over-reaction. The distance phoria may reflect this process of recovery from stress, distance esophoria representing a failure to recover totally from stress activation, and distance exophoria occurring as the result of an overreactive or excessive recovery.

Prevention and treatment

Preventive care requires early identification of those at risk. A near phoria measure significantly less than the expected 6° exo and a low P.R.A. finding are frequently among the earliest signs of nearpoint stress. Overconvergence may manifest as a progressive eso shift when attentional demands are sustained, as in cheirosopic tracing or repeated near phoria measures. Constricted prism vergence and/or accommodative findings suggest interference with binocularity and lack of adequate freedom between accommodation and convergence. When early signs are overlooked or ignored, they are usually followed by the development of myopia and/or other adaptations.

Optometric intervention involves the appropriate use of near-point lenses, guidance regarding appropriate visual hygiene for nearpoint application, and/or vision training.

Plus lens application at nearpoint serves to reduce accommodative demand and associated overconvergence, so that focus and alignment localize in the same plane. The optimal lens power to reduce effector system mismatch may be determined on the basis of O.E.P. case analysis, traditional graphical analysis, or Schor and Narayan’s graphical analysis of the interaction between convergence accommodation and accommodative convergence.

Visual hygiene

Children frequently read and write under working conditions which are detrimental. Poor illumination, reading and writing while lying in a bed or on the floor, and working at desks which are too high tend to foster extremely close working distances, which impose excessive demands upon accommodation and convergence. Even when habitual working conditions are adequate, there is a tendency to pull reading material close under conditions of stress and tension, or when material is difficult and requires concentration.

Adoption of proper near work habits may help to reduce stress on the visual system. Adequate posture and lighting help to foster an optimal working distance. Patients should be encouraged to sit erect in a comfortable chair while reading,
holding the book in the lap. Small children should work, at home and at school, at desks which are properly sized. Patients should be advised to take short breaks to reduce intensity during prolonged near vision application, and to get up and move about for a moment every 15 or 20 minutes. Such movement serves to reduce physiological arousal. Patients are well-advised to shift gaze to distance at the end of each page, while turning to the next page. Such gazeshifts facilitate maintenance of accommodative flexibility, and may help to reduce the marked hysteresis, or incomplete relaxation of accommodation, associated with fixation at near. Even short periods of nearpoint activity produce accommodative hysteresis which decays slowly, suggesting a long-lasting increase in ciliary muscle tonus which may be a precursor to near-work induced myopia.

**Visual training**

Vision training is utilized to improve visual skills and abilities, to eliminate functional inhibitions which develop adaptively, and to develop greater flexibility between the effector systems of accommodation and convergence. Treatment usually includes monocular accommodative rock training, to optimize accommodative function in each visual circuit, and fusion range extension and binocular accommodative rock training to develop flexibility between accommodation and convergence. Such treatment, combined with nearpoint lens application to reduce oculomotor imbalance, is generally quite successful in permitting efficient, comfortable near work and preventing the development of secondary problems.

**Stress reduction techniques**

The effectiveness of meditation in reducing the physiological stress response is well-documented.65,66 Meditation produces a counter-stress response, a configuration of physiological responses opposite to that induced by stress which has been termed "the relaxation response".63 Meditation techniques involve the adoption of a "passive concentration", or less intense looking style, and the development of greater control over inner control over inner verbalization, the internal chatter which generates stress as it continually and judgementally reviews the past and previews the future, reducing awareness in the here and now.64 Vision therapy techniques may be modified so as to incorporate aspects of stress reduction and physiological relaxation.65 Such techniques may be helpful, especially in resistant cases demonstrating persistent overconvergence and/or constricted base in fusion ranges. Stress and heightened arousal produce constriction of attention and narrowing of the perceptual field.66 Peripheral awareness techniques seek to expand the field of perceptual awareness,65,67 This is achieved by adopting a more passive form of concentration, a more global, less intense attentional set. Development of greater awareness and control over internal verbalization may be incorporated so as to counter stress and further reduce physiological arousal. The patient is asked to look easy, with passive concentration, and to maintain simultaneous awareness of the entire visual field. He should notice his inner verbalization when it occurs; and to seek to push it away and resume total awareness of the here and now. Improved ability to "look easy" with passive concentration, to expand awareness and to control inner verbalization may significantly reduce physiological stress activation, particularly if practiced several times throughout the day.

Visual imagery techniques also serve to reduce inner verbalization and generate physiological counter-stress responses. Additionally, imagery techniques can be designed to incorporate relaxation and a feeling of looking far away, supporting reduction of overconvergence and the development of base in skills.65,67,68,69

When stress reactivity and/or exposure to stress is extreme, referral may be indicated for more extensive stress reduction therapy to supplement vision training, in order to achieve desirable levels of visual function. Such patients may benefit from meditation and relaxation therapies, biofeedback training, counselling, psychotherapy, and lifestyle changes to reduce general stress and to increase coping abilities.70 As primary care providers, optometrists should acquaint themselves with the various approaches to stress reduction, and advise patients regarding the value of such approaches in the prevention and control of stress-induced vision disorders and of other stress-induced illness.

Modifications in physical classroom design have been recommended to reduce stress on the vis-

**Vision therapy techniques may be modified so as to incorporate aspects of stress reduction and physiological relaxation. Such techniques may be helpful, especially in resistant cases demonstrating persistent over-convergence and/or constricted base in fusion ranges.**
ual system, but little has been done to apply general stress reduction principles in the classroom. Stress management programs utilizing relaxation techniques, exercise and nutritional counselling are in common use in the business world to prevent illness in coronary-prone executives. School intervention programs introducing visual hygiene and techniques to reduce general and visual stress might effectively supplement lens application and vision therapy in the prevention and management of vision disorders. In China, "eye exercises" which emphasize relaxation have long been part of the daily classroom routine.

Conclusion

The purpose of this paper has been to summarize the clinical aspects of the nearpoint stress model, and to present clinical evidence and report clinical experience in support of the model.

The model holds that the nearpoint tasks of our culture present demands for attention and mental effort which generate autonomic activation which leads to a mismatch between the effector systems of accommodation and convergence. These effects are exacerbated by the high stress levels prevalent in our society, and may be especially pronounced in individuals who are hyper-reactive to stress, or whose ability to cope with stress is fragile.

The resultant tendency for convergence to localize closer than accommodation may be observed during routine phorometric analysis when patients demonstrate esophoria, or esophoria less than the expected 5 or 6. This overconvergence tendency is particularly evident during tasks which present demands for sustained vigilant attention, including sequentially repeated near phoria measures and cheiroscopic tracing. The presence of an overconvergence tendency which may be significantly greater under fused conditions than that measured during the dissociated near phoria test, suggests the inadequacy of the traditional notion of a fixed near phoria, and of derivative case analysis systems which view phoria and prism vergence measures as fusional demands and reserves.

The earliest signs of nearpoint stress include a low P.R.A. finding and the presence of esophoria or lower-than-expected exophoria at nearpoint. These findings indicate interference with efficient nearpoint binocular function, and often signal the development of adverse adaptive changes.

Common adaptations include myopia, accommodative insufficiency and convergence insufficiency. These conditions are viewed in the nearpoint stress model not as primary problems, but as adaptive changes to relieve or facilitate function in the presence of nearpoint stress-induced overconvergence. Myopia serves to reduce accommodation demand and hence associated overconvergence; accommodative insufficiency represents an inhibition of accommodation to reduce overconvergence; and convergence insufficiency results from a recalibration of the relationship between accommodation and convergence to create a higher esophoria to buffer overconvergence.

These adaptations constitute nearpoint stress-induced vision disorders. They resemble systemic stress-induced illness in that both arise as a result of the activation of autonomic reflexes which, although biologically appropriate, lead to malfunction when activated in response to the stresses and demands pervasive in our culture.

Duke-Elder states: "Moreover, the eye as the dominant sensory organ is a development only recently established in phylogenetic history, while the exorbitant demands of a complex and artificial civilization have put upon it highly aphasisiological strains and stresses, the extent of which is difficult to appreciate adequately. Although from long custom, we accept the conditions under which we live today as normal, it by no means follows that the eye has evolved to cope with them, and the fact that it is able as a rule to meet the demands which are made upon it, is a compliment of no mean order to the extreme adaptability of living organisms."

While many individuals develop adaptations to nearpoint stress in order to facilitate function, each adaptation imposes its own limitations and disadvantages. Rather than adapt, some individuals persevere in the presence of effector system mismatch, experiencing asthenopia and inefficiency. Subtle interference with efficient binocular function is common, and is reflected in lower blur, break, recovery and accommodative measures. These findings do not represent primary problems, but result from interference with binocular function caused by inability to effectively integrate or match accommodation and convergence.

Still other individuals avoid or minimize nearpoint activity. The absence of symptoms in such cases does not indicate lack of a visual problem; rather, lack of interest in reading is often a major symptom of nearpoint stress-induced vision disorders.

The treatment and prevention of nearpoint stress-induced vision disorders involves the application of appropriate lenses to reduce effector system mismatch at nearpoint; guidance regarding appropriate work and study habits to minimize stress; and vision training to remediate impaired function and to improve ability to cope with stress on the visual system. Stress reduction techniques may be a useful supplement.

Early identification and initiation of treatment is important, since nearpoint stress may cause discomfort, interference with academic and vocational achievement, and the development of adaptations which in turn impose their own limitations. Frequently, patients simply avoid
near work, with consequent limitation of achievement and potential. These conditions are so widespread as to present a major barrier to human potential. They present a major challenge to optometry to provide care which will allow patients to achieve the potential of which they are capable.

Submitted for publication 4/84
Revised 12/84

State College of Optometry
SUNY
100 East 24th Street
New York, NY 10010

References

17. Birnbaum MH. "Functional relationship between myopia, accommodative stress and against-the-rule astigma: A hypoth-
20. Skelhington AM. "The Hyperope". Prac
23. Skelhington CM. "Fixation Disparity and Ver-

Volume 56, Number 6, 6/85 489

<table>
<thead>
<tr>
<th>QUAN</th>
<th>MODEL</th>
<th>COLOR</th>
<th>PRICE</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>2A Stem (16&quot;-21&quot;)</td>
<td>$96.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25B with Footring</td>
<td>$133.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Enclosed: □ Check □ Money Order □ MasterCard □ VISA

Credit Card No. ____________________
Exp. Date ____________________

Mail this handy order blank to: FURNIPA, INC.
P.O. BOX 867 • MINOT, ND 58702

NAME _____________________________
STREET ____________________________
CITY ___________________ STATE __________ ZIP ____________

American Heritage
DMV Remover
Hard lenses

DMV II (Vented)
Hard lenses

S.L.R.
Soft lens Remover / Inserter

EUROPEAN OUTLET
Ott Konaktlassen
Josefstrasse 53 Postfach 279
CH 8031 Zurich, Switzerland

DMV Corporation
Quality Contact Lens Accessories
Box 2829 - Zanesville, Ohio 43701
614/452-4787

MADE IN U.S.A.

FURNIPA
Automatic Height Adjustment CHAIRS AND STOOLS
Reduce fatigue and backaches with Furnipa's automatic height adjust­
ment chairs and stools.
• Order direct and save! Price includes shipping costs!
• 100% guaranteed. If you are not completely satisfied, we will refund your money within six weeks after delivery.

MAIL THIS HANDY ORDER BLANK TO: FURNIPA, INC.
P.O. BOX 867 • MINOT, ND 58702

NAME _____________________________
STREET ____________________________
CITY ___________________ STATE __________ ZIP ____________

QUAN | MODEL | COLOR  | PRICE | TOTAL |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2A Stem (16&quot;-21&quot;)</td>
<td>$96.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25B with Footring</td>
<td>$133.00</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Enclosed: □ Check □ Money Order □ MasterCard □ VISA

Credit Card No. ____________________
Exp. Date ____________________

ALL NYLON UPHOLSTERY

<table>
<thead>
<tr>
<th>QUAN</th>
<th>MODEL</th>
<th>COLOR</th>
<th>PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>3600 Silv Satin</td>
<td>3608 Rust</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3601 Envy</td>
<td>3609 Walnut</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3602 Fawn</td>
<td>3610 Toast</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3603 Olive</td>
<td>3611 Tangerine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3604 Gold</td>
<td>3612 Forest</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3605 Cardinal</td>
<td>3613 Apple Green</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3606 Fiery Red</td>
<td>3615 Burgundy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3607 Midnight Blue</td>
<td>3616 Coral</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TOTAL AMOUNT

Please allow two to three weeks for delivery.

Please send me more information.