ACUTE ACCOMMODATIVE AND CONVERGENCE INSUFFICIENCY

BY *Malcolm L. Mazow,* MD, *Thomas D. France,* MD,
Sandra Finkleman, CO (BY INVITATION),
Jacqueline Frank, CO (BY INVITATION) AND (BY INVITATION)
Patricia Jenkins, CO

INTRODUCTION

READING EASILY AND COMFORTABLY IS OF PARAMOUNT IMPORTANCE IN THE intellectual development of the child and young adult. It is a relative facility of accommodation and convergence that allows the young person to read at close range. When these mechanisms fail, reading becomes tiring, frequently producing headaches and even diplopia.

Asthenopia in a school-age individual can be a significant handicap to learning. An inability to concentrate on written material creates frustration, impeding the learning process. Once the refractive error has been corrected and the symptoms persist, evaluation of the patient for mechanisms of binocular dysfunction is carried out.[1,2]

Convergence insufficiency syndrome is defined in a variety of ways. This abnormality includes remote near-point of convergence and decreased amplitudes of convergence compared to divergence with poor recovery once fusion has been broken. These defects individually or in any combination, are enough to create symptoms.[3-7]

Over the past 4 years, we treated 26 young patients with asthenopic symptoms who had a combination of profoundly decreased accommodation and convergence in the absence of any other neurologic symptoms or signs. This retrospective study looked at this group to evaluate the relationship between abnormal accommodation and the findings of convergence insufficiency.

METHODS

The initial study incorporated the patients from two centers in a retrospective evaluation. The number of patients (72) was reduced to 26 as

adequate measurements of all parameters were not obtained and some lacked adequate follow-up.

In order to eliminate the possibility of early presbyopia, only patients under age 30 years were considered. No other neurological complaints existed. The patients were symptomatic when reading, complaining of headaches, blurred near vision, and fatigue. Pupil examinations were normal as was the near reflex, assuring no inclusion of patients with internal ophthalmoplegia. All patients demonstrated good fusion.

The patients were evaluated with a complete ophthalmological examination including vision at distance and near, cycloplegic refraction, pupil and motility examination, near-point of accommodation, near-point of convergence, amplitudes of convergence and divergence at both distance and near, as well as both slit lamp and fundus examinations.

The near-point of accommodation was measured in a standard method with the full refraction in place. The 20/40 line was moved away from the nose along the centimeter diopter reading bar until the patient indicated clear recognition of the line. This was repeated three times and the average distance from the patient was considered the near-point of accommodation. The measurement was taken both monocularly and binocularly.

Near-point of convergence was measured both objectively and subjectively. The subjective measurement was done three times by placing a red filter over one eye, and moving a flashlight towards the nose until diplopia (crossed) was experienced. When psychophysical suppression was noted (all red or white alone seen and not diplopia) the patient was eliminated from the study. Objective near-point of convergence was measured using a light and moving it towards the nose. When convergence ceased, an outward movement of one eye was observed indicating the objective near-point of convergence. Since these patients had a remote (decreased) near-point of accommodation, an accommodative target was not used for the objective determination of near-point of convergence.

The angle of squint was measured by using both the cover/uncover test and alternate cover test at distance and near. Fusional amplitudes were measured doing divergence break/refuse at distance and near first, and then convergence break/refuse at distance and near (blur was not measured). The actual values of divergence and convergence amplitudes were measured from the angle of deviation and not from 0. For example, if the patient had 6 prism diopters of exophoria at near, and his convergence amplitude was 20/15 prism diopters from the 0 point, his true convergence amplitudes were 26/21 prism diopters.

TREATMENT

All patients received ocular muscle therapy. Twenty-two of 26 (84.6%) patients were treated with orthoptic exercises to improve convergence. These included sustained near-point convergence exercises, sustained red glass near-point[3,8] convergence, and exercise prisms. Twenty-one of 26 (81%) were given plus lenses to aid with accommodation. The lens power ranged from +1.00 to +2.50 with each patient being given the weakest plus lens that afforded comfortable near vision. This allowed stimulation of the remaining accommodation. Some were placed in bifocals for convenience in school and some were placed in reading glasses. No patient required base-in prisms and none were treated with drugs. Miotics have not been found to be effective in accommodative and convergence insufficiency and may increase the exodeviation at near.

Patients were seen on follow-up visits with reassessment of symptoms and re-measurement of parameters. Patients were seen for a mean of 3.3 visits (range, 2 to 6 visits) over an average of 11.8 months (range, 0.5 to 47 months).

RESULTS

Of the 26 patients included in this study, 19 were female, 7 were male; a nearly 3:1 preponderance of females. The patient's ages ranged from 7 to 28 years with a mean of 11.6 years. Vision at distance ranged from 20/15 to 20/50 with no more than 1 Snellen line difference between eyes for any patient.

On motility examination, 10 of 26 patients were orthophoric at distance, with the remainder ranging up to 3 prism diopters exophoria at distance. At near, the patients ranged from 2 prism diopters esophoria to 4 prism diopters exophoria with the exception of two patients who showed intermittent exotropia at near.

The near-point of accommodation was markedly reduced for these patients when compared to the Duane's curve, as seen in Fig 1.[9] The mean was 8 diopters with a range of 2 to 23 diopters. This represents an average of 3 to 6 diopters less than normal for age. One patient on initial examination demonstrated 23 diopters of accommodation, but on second examination, only 10 days later, had 8 diopters of accommodation. She was included in this study.

Fig 2 reveals that the near-point of convergence ranged from 5 cm to greater than 50 cm with a mean of 20.7 cm. Normal near-point of convergence is considered less than 10 cm.

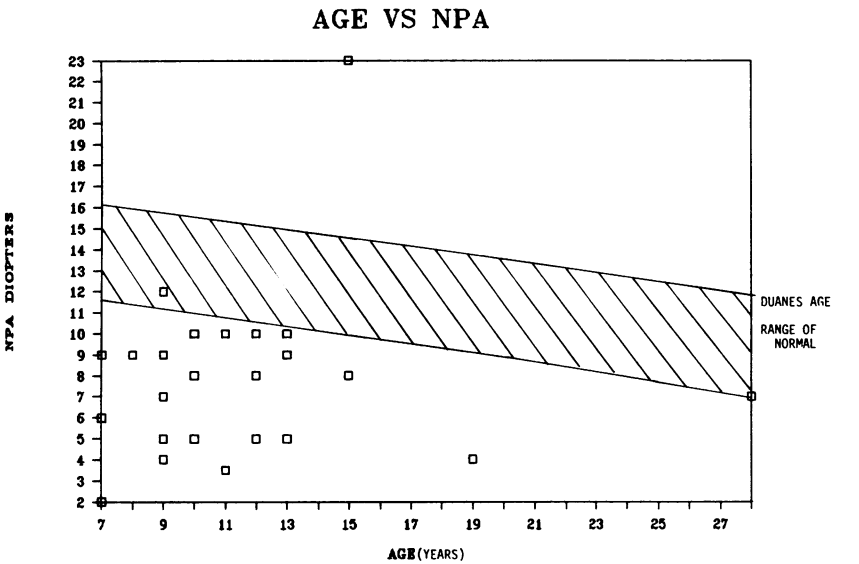

FIGURE 1
Comparison of near-point of accommodation in diopters for the study of patients as compared to Duane's normals.

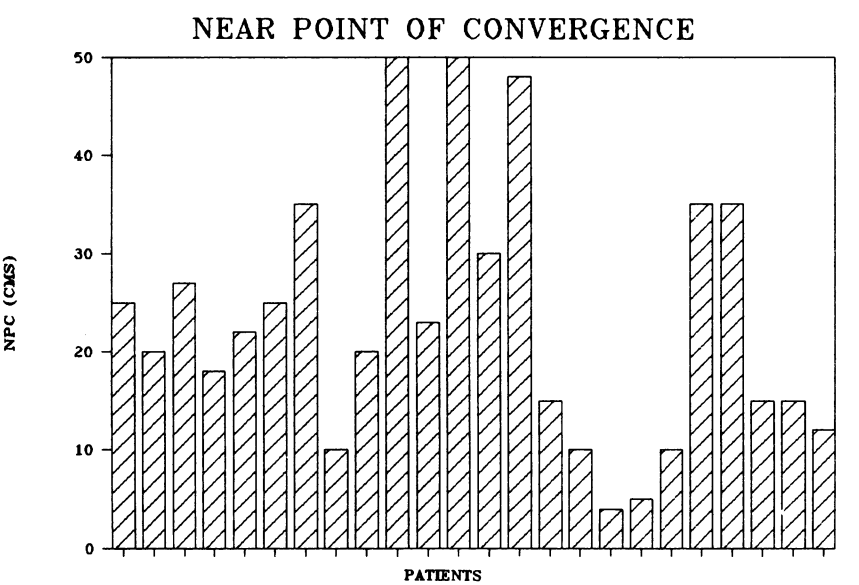

FIGURE 2
Near-point of convergence for individual patients in this study.

Seventeen of 26 patients (65.3%) showed definite improvement after treatment and were completely asymptomatic. This does not mean that patients had stopped doing orthoptic exercises or had abandoned use of plus lenses. The patients were allowed to continue the use of reading glasses and encouraged to do enough exercises to remain comfortable. Seven of 26 patients (26.9%) reported some improvement of symptoms, that is, fewer headaches, less trouble with blurred near vision, and less problems reading.

Two of 26 patients (7.6%) reported *no* improvement of symptoms. However, both of these patients had been treated for less than 2 months.

Near-point of accommodation, near-point of convergence, and amplitudes of convergence were re-measured at follow-up visits. Eleven of 26 patients (42.3%) still demonstrated objective evidence of accommodative insufficiency and convergence insufficiency, even though 5 of the 11 (45.4%) were completely asymptomatic. One patient continued to demonstrate accommodative insufficiency without convergence insufficiency and was asymptomatic. After therapy, nine patients (34.6%) showed convergence insufficiency with normal near-point of accommodation and seven of these nine (77.7%) were asymptomatic. Only five patients (19.2%) showed normal accommodation and convergence and four of those five (80%) were asymptomatic.

Comparison of pre- and posttreatment near-point of convergence and accommodation were divided into those who were asymptomatic after therapy (17 of 26) and those continuing to exhibit symptoms (9 of 26). The mean near-point of convergence in the asymptomatic post-therapy group was 27.9 cm pretreatment and 13.8 cm post-therapy. The mean near-point of convergence in the nonresponsive group was 15.7 cm pretreatment and 21.4 cm post-therapy (Table I and Fig 3).

The mean diopters of accommodation pretreatment in the successful group was 7.1 diopters and following treatment was 11.4 diopters. The nonresponsive group was 9.2 diopters and 9.3 diopters, respectively in the pre- and posttreatment phases (Table II and Fig 4).

Following a repeated measure analysis of variance convergence amplitudes showed no significant difference between pre- and post-therapy measurements (Table III and Fig 5).

Only 25% of the asymptomatic patients demonstrated resolution of accommodative insufficiency and convergence insufficiency by objective criteria. A similar percentage, 5 of the 17 (29.4%) asymptomatic patients, still revealed combined accommodative insufficiency and convergence insufficiency. Seven of 17 (41%) asymptomatic patients still demonstrated convergence insufficiency.

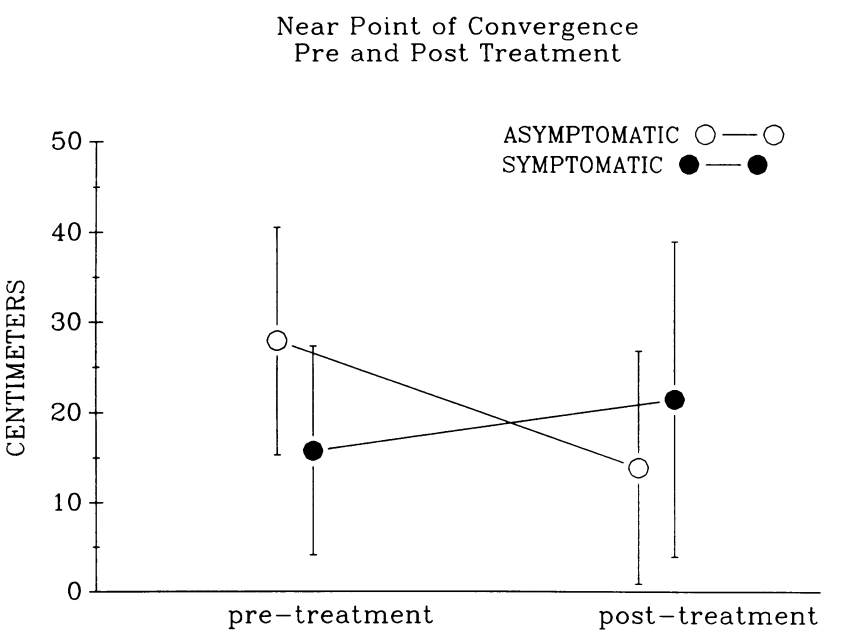

FIGURE 3

This figure is a comparison of near-point of convergence of 17 of 26 patients asymptomatic after therapy with 9 of 26 patients who remained symptomatic following therapy. The range and mean of each group is demonstrated pre- and post-therapy.

TABLE I: MEAN NEAR-POINT OF CONVERGENCE

NEAR-POINT CONVERGENCE	MEAN (cm)
Asymptomatic	
Pretreatment	27.9
Posttreatment	13.9
Symptomatic	
Pretreatment	15.7
Posttreatment	21.4

Mean NPC pre- and posttreatment in 17 of 26 patients who after treatment were asymptomatic as compared to 9 of 26 patients who after treatment were still symptomatic.

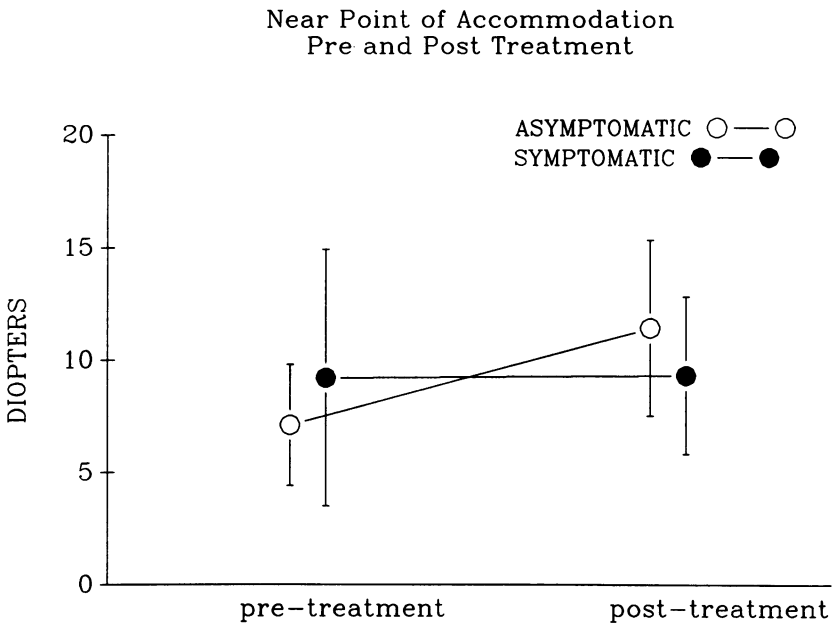

FIGURE 4
This figure is a comparison of near-point of accommodation of 17 of 26 patients asymptomatic after therapy with 9 of 26 patients who remained symptomatic following therapy. The range and mean of each group is demonstrated pre- and post-therapy.

TABLE II: MEAN NEAR-POINT OF ACCOMMODATION

NEAR-POINT ACCOMMODATION	MEAN (D)
Asymptomatic	
Pretreatment	7.1
Posttreatment	11.4
Symptomatic	
Pretreatment	9.2
Posttreatment	9.3

Mean NPA pre- and posttreatment in 17 of 26 patients who after treatment were asymptomatic as compared to 9 of 26 patients who after treatment were still symptomatic.

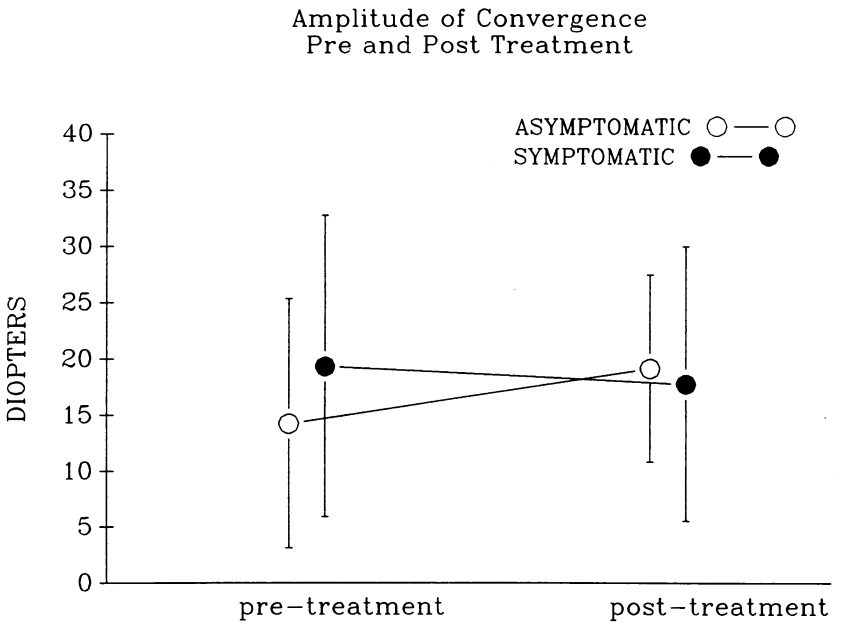

FIGURE 5
This figure is a comparison of amplitude of convergence of 17 of 26 patients asymptomatic after therapy with 9 of 26 patients who remained symptomatic following therapy. The range and mean of each group is demonstrated pre- and post-therapy.

TABLE III: MEAN AMPLITUDE CONVERGENCE

AMPLITUDE CONVERGENCE	MEAN (D)
Asymptomatic	
Pretreatment	14.2
Posttreatment	19.1
Symptomatic	
Pretreatment	19.3
Posttreatment	17.7

Mean amplitude convergence pre- and post-treatment in 7 of 26 patients who after treatment were asymptomatic as compared to 9 of 26 patients who after treatment were still symptomatic.

DISCUSSION

Accommodative insufficiency combined with convergence insufficiency has been an often overlooked cause of asthenopic symptoms in children and young adults. The two major studies in the ophthalmological literature cover a total of 12 patients.[10,11]

We have increased this number by 26 patients all of whom fulfill the criteria of accommodative and convergence insufficiency. The mean age of patients was 11.6 years as compared to the studies of von Noorden et al[10] and Chrousos et al[11] which were 22.4 years and 13 years, respectively. All patients aged 30 years and over were eliminated to rule out pre-presbyopic presbyopia. The marked discrepancy between the number of females and males having this condition may be of interest. Only one other study on accommodation demonstrated the female preponderance[12]; whereas Duane[13] found just the opposite.

This present study included two patients with intermittent exotropia at near and two patients with an exophoria of 10 to 15 prism diopters. This is a population different from von Noorden's study where (5 of 9) 55% of the patients were intermittently exotropic at near. If one considers a convergence insufficiency syndrome as different from a convergence insufficiency type of exotropic deviation, then this study fulfills the criteria of convergence insufficiency syndrome associated with accommodative insufficiency. Intermittent exotropic deviation connotes a decrease in sensory status. The stereoscopic vision was excellent in all the patients except one who had 400 seconds of arc.

The presenting symptoms of six patients were those of convergence insufficiency with a slightly decreased near-point of accommodation. As expected, all patients in this group had a remote near-point of convergence established by the subjective method. In subsequent visits, the decrease in accommodation became apparent. In these patients, convergence insufficiency occurred before accommodative insufficiency, but the combination of the two ultimately was present. This finding suggests that every patient being managed for convergence insufficiency should have their near-point of accommodation evaluated in subsequent visits. It is obvious that if the near-point of accommodation becomes remote then the convergence insufficiency therapy must include therapy for accommodative insufficiency.

Twenty-four of the 26 patients (92.3%), have shown marked subjective improvement of visual symptoms. Whether treatment with glasses, bifocal glasses, convergence exercises or a combination of these, all 24 patients reported relief of some of their symptoms. Their reading habits improved and their headaches decreased. In addition, their school perfor-

mance improved dramatically. Objectively there was very little difference between pre- and post-therapy measurements.

However, if one closely scrutinizes Fig 3, there is a trend towards improvement of the near-point of convergence in the group of patients (17 of 26) who were asymptomatic following therapy. The improvement in these patients was from 27.9 to 13.8 cm (range, 14.1 cm). In comparison, the near-point regressed from 15.7 cm to 21.4 cm in the nonresponsive group. There is no explanation for this regression of the near-point of convergence of 5.7 cm.

Fig 4, although not as dramatic, demonstrates an improvement in the near-point of accommodation after therapy. The mean near-point of accommodation seen in this Fig as well as in Table II increased from 7.1 diopters to 11.4 diopters (difference = 4.3 diopters) in the successful group, whereas the nonresponsive patient had only 0.1 diopter change.

No significant difference of amplitudes of convergence in the successful and failure group can be seen in Fig 5 and in Table III.

What does this suggest? Because the symptoms are markedly improved with therapy and yet the objective measurements of near-point of accommodation and in certain instances near-point of convergence are not any better, one must speculate that the methods we use for determining near-point of accommodation and near-point of convergence are not adequate. None of the techniques for evaluating near-point of accommodation measure the *sustained* near-point of accommodation. Likewise, we do not assess *sustained* near-point of convergence. A 7-year-old child with 9 diopters of accommodation has significantly decreased accommodation. He should still be able to function at near using 3 diopters for work, leaving 6 diopters in reserve. This however, is not the case. Momentarily this child may be able to accommodate, but rapidly his ability to focus regresses, making it impossible to sustain the accommodation necessary to function at near. Without measuring a sustained near-point of convergence, their problem may not be diagnosed.

The results of this study show that subjective complaints of accommodation and convergence insufficiency were dramatically improved with therapy but no significant objective improvements were noted. These results suggest that we must devise a technique for measuring sustained near-point of accommodation and sustained near-point of convergence. Without objective criteria to substantiate improvement, it is always possible that the placebo effect of any therapy could cause subjective improvement of symptoms.

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DISCUSSION

DR LEONARD APT. It seems remarkably appropriate that members of our program committee saw fit to select a paper dealing with accommodation and convergence dysfunction for presentation at this 125th anniversary meeting of the American Ophthalmological Society. In 1864, the year of the first meeting of this Society, Franciscus Cornelius Donders published his classic work *On the Anomalies of Accommodation and Refraction of the Eye*. In that book, Donders introduced the concept of accommodative asthenopia—the disturbing symptom complex that led to Doctor Mazow and his associates' study. Indeed, Donders was the first person to insist that most of the symptoms of eyestrain were due to "the fatigue of the muscular system of accommodation."

Of additional historical interest of this audience is that one of our Society's esteemed deceased members, Alexander Duane, presented one of his landmark papers on anomalies of accommodation at the 51st Annual Meeting of the American Ophthalmological Society in July 1915 (*Trans Am Ophthalmol Soc* 1915; 14, Part I:386-402). In the first paragraph of this paper, Doctor Duane pointed out that little attention has been given to accommodation anomalies even though they often cause considerable trouble in our day-to-day practice. That statement, 74 years later, still holds true.

Today Doctor Mazow and his co-workers have presented their experience with 26 young, mostly school-age patients who had an acute onset of asthenopic

symptoms when reading or performing near tasks. These patients were healthy and had normal eye examinations except for subnormal near points of convergence and accommodation, and amplitudes of convergence. The results of treatment utilizing convergence exercises, with or without plus lens additions, were quite favorable to the patients and to Doctor Mazow and his colleagues, but, I must confess, rather perplexing to this reviewer. Let me explain.

The authors' report that 24 of the 26 patients with treatment showed "marked subjective improvement of visual symptoms. Their reading habits improved and their headaches decreased. In addition, their school performance improved dramatically." Objectively, however, Doctor Mazow and co-workers found little difference between pre- and post-therapy measurements. This discrepancy is further borne out when the 26-patient group was divided into those who became asymptomatic with treatment (17 patients) and those who remained symptomatic with treatment (9 patients). Of the patients in the asymptomatic group, on objective testing, 41% still had convergence insufficiency, 29% had convergence and accommodation insufficiency, and only 29$ had normal convergence and accommodation test scores. Thus 70% of the patients who claimed to be asymptomatic still had objective evidence of convergence insufficiency with or without accommodation insufficiency.

Doctor Mazow did find two positive trends in response to treatment, namely, those patients who became asymptomatic after therapy did show an improvement over their pretreatment near-point convergences (NPCs) and near-point accommodations (NPAs) when the mean values for each of these measurements were used. I intentionally use the author's term "trend" because no statistical analysis or complete tabulation of data for any of the functions in the study appeared in the written text. Without knowledge of standard deviations and full information on each of the 26 patients, statistical analysis of the data by this reviewer was not possible.

Even if improvement in the measurement of the NPC and NPA in the asymptomatic group proved statistically valid, the responses cannot be considered a clinical cure. A posttreatment mean figure of 14 cm for the NPC, down from 28 cm, is still abnormal since it exceeds the authors' top normal of 10 cm. Similarly, a posttreatment NPA mean figure of 11 diopters, up from 7 diopters, probably is also abnormal because 11 diopters represents the normal mean value for a 20-year-old person, and the mean age in this asymptomatic group most likely is much younger; over 80% of the patients in the study group were from 7 to 13 years old. The actual mean age of the patients in the asymptomatic group was not given in the paper. I again emphasize that a statistically significant difference in numbers does not necessarily indicate a significant clinically relevant change.

In clinical research studies the criterion for cure or improvement generally entails concomitant change in both subjective and objective findings. How does one then explain the discrepancy in this study in which success is based mainly on subjective responses rather than objective test results? I suspect the flaw lies on the subjective side of the equation. After all, the objective tests used in the study are well established and the tests were performed by experienced pediatric

ophthalmologists and orthoptists. In my experience, a genuinely favorable subjective response to treatment is accompanied by a commensurate quantitative response.

From a subjective standpoint, symptoms of visual dysfunction and discomfort are difficult to evaluate, especially quantitatively. They may be influenced by confounding sources such as emotional disturbances, stress, and fatigue. In reality, complaints of visual discomfort may or may not be solely a function of accommodation and convergence insufficiency.

Also, complaints may not be authentic. For example, on occasion I have been told by parents that Johnny is not doing well in school and complains that his eyes get tired when he does his homework. Yet, on subtle questioning, I learn that he can spend hours reading comic books, or watching TV at close range (or looking at Playboy Magazine).

The decided subjective improvement of visual symptoms in many of the patients without comparable improvement in objective findings suggests that the favorable change may have been brought about by factors other than the treatment, such as interest and support shown by their doctors, orthoptists, parents, and teachers; by easement of emotional stress; by expenditure of parents' money for treatment; and perhaps merely by the passage of time. Of course, I am referring to the placebo effect.

Doctor Mazow and colleagues suggest that the present methods for testing the NPC and NPA may not be correct, and may account for the discrepancy between subjective and objective findings in their group of patients. They postulate that by measuring a sustained rather than momentary NPC and NPA one may be able to identify the cause of asthenopia in more patients. No studies on this point were actually performed or reported by the authors. Although this speculation may have merit, it seems irrelevant in the present study because the eye problems presented by their patients were diagnosed by finding abnormal NPC and NPA. The authors were not faced with the dilemma of making the diagnosis of convergence or accommodation insufficiency in patients with asthenopia who had normal NPCs or NPAs by the usual testing technique.

I may add that the idea of fatigue of accommodation is not new. Over the years many studies on the subject have been carried out. Again, our Doctor Duane in his 1915 AOS paper cited this abnormality (*Trans Am Ophthalmol Soc* 1915; 14, Part I:389, Item 2). Furthermore, some of the important early papers on this topic were written by distinguished members of the American Ophthalmological Society including Doctors Walter Lancaster, Conrad Berens, and Lucien Howe. In recent years more sophisticated methods of study have been performed by workers using direct measures of accommodation with laser and polarized vernier optometers. Doctor Mazow and his associates may wish to review these reports if they decide to initiate a new study.

In closing, I am grateful to Doctor Mazow and his collaborators for broaching this subject. As they point out in their paper, only a few publications on the topic appear in the ophthalmic literature. Yet, any ophthalmologist who sees a number of students or young adults who do a great deal of close work will concede that

asthenopia is a common problem. My impression is that many ophthalmologists handle this disorder poorly. Too often they consider most cases of asthenopia in young persons as instances of uncomplicated convergence insufficiency and treat these patients with simple push-up exercises. This unsophisticated approach ofttimes is not helpful and the patient leaves dissatisfied. Many ophthalmologists do not fully appreciate the role and function of the process of accommodation and convergence, their interrelationship, and how to study their dysfunctions. Thus proper treatment is not given. Many of these patients end up under the care of optometrists.

The optometry profession seems more interested in the problem of convergence and accommodation than the ophthalmology profession. This impression is supported by the results of my recent Med-Line literature search on the subject covering the past 10 years, which elicited 81 articles in optometric journals and only 7 in the ophthalmic literature. I ask my fellow ophthalmologists: have we abdicated to optometry still another area of eye care that already includes dyslexia, school vision screening, so-called "fusion training" of strabismic patients, and sports vision? I certainly hope the trend does not continue.

Dr George L. Spaeth. A couple of thoughts come to mind as I have listened to this. The assumption was that indeed accommodative and convergent problems were responsible for the symptoms, but that is only an assumption, of course. One way in which you might be able to get at that is to look at the four patients who didn't get orthoptic training that were in your group. As I recall from the slide, 22 to 26 had orthoptic training. What happened to those four who didn't? The other thought as if you were to look at this again, wouldn't it be nice to sort the patients out and put them into two groups—one control and one treatment. Those measuring the results, the "testers," are going to want the patients to get better; the trends about which Doctor Apt spoke may have been nothing except expectations of the "testers" that the patients should be doing better. In expecting the patients to do better, the patients would perform the subjective tests in a way that actually was "better," but in fact the patients would not have improved. The only thing that would have improved was the testers' expectations of how the patients should do.

Dr Gunter K. von Noorden. In 1973 we published on a similar group of patients (*Doc Ophthalmol* 34:393-403). Unlike Doctor Mazow our results with orthoptic therapy were disappointing in this entity. We pointed out in our study that patients with combined convergence-accommodation insufficiency must be clearly distinguished from ordinary convergence insufficiency where the NPA is normal or at the lower range of normal. It is important, therefore, to check the NPA before embarking on orthoptic treatment for convergence insufficiency. If it is reduced, orthoptics will be of little help; if it is normal, orthoptics is, as a rule, eminently successful.

Doctor Mazow reported a slight improvement of a reduced NPA after treatment. What kind of treatment was used to improve the NPA?

DR DAVID L. GUYTON. I also am puzzled by the lack of correlation between the apparent clinical improvement and the objective findings. I agree with Doctor Mazow that this may indicate we are not measuring the proper parameters. In fact we have probably abdicated the study of accommodation and convergence to the optometric profession. A perusal of the literature will reveal that most of the advances in this area are being made in the optometric institutions by vision scientists who use definitions and terms with which we are not even familiar.

Perhaps it is the ability to sustain accommodation that we should be measuring instead of convergence. Or perhaps we should be measuring accommodative inertia or "infacility"—the inability to focus back and forth quickly between two distances. We do not een recognize the term "infacility" in our medical language.

There is a simple objective way to monitor accommodation that is the main point of my discussion. This is dynamic retinoscopy, dating back to ophthalmology in the 1920s. The patient is instructed to look at a distant object with distance refractive correction in place, and then look at a near "accommodative" target held just below the retinoscope peephole. Some light falling on the near target is necessary so that the patient can see it, and accommodation is most reliably elicited if the patient holds the near target, providing a proximal stimulus. As the patient looks from the distant to the near target, with no working lens in place, the retinoscopic reflex will change from "with" movement to neutralization if accommodation is complete. The examiner can easily judge how quickly the patient can focus back and forth and how well accommodation is sustained at near. This is a very simple test that may indeed provide some much-neglected ophthalmological insight into accommodation abnormalities.

DR SUZANNE VÉRONNEAU-TROUTMAN. I would like to congratulate Doctor Mazow and coauthors for having addressed this important topic. I question why they had patients who got worse after orthoptics. I would like to ask them if these patients had any medical problem. Such a finding is uncommon in an otherwise healthy patient with a well conducted orthoptic treatment.

It is interesting that the authors had an important group of their patients who got subjectively better although objectively unchanged. It is always puzzling in practice to find a patient with poor convergence, poor amplitude of fusion being asymptomatic. For the symptomatic patient who did not respond to orthoptics was prismotherapy considered?

DR LEONARD APT. I would like to add to the discussion the fact that a number of drugs may cause or contribute to accommodation weakness. Eye doctors may not be cognizant of this possibility and thus may not ask about medication or drug use in taking the patient's history. Even if questioned, however, patients may not admit to the use of any drugs. Also, some patients may not respond affirmatively to a question about drug intake because they are unaware that the medication they have been taking has anything to do with their eye complaints.

To illustrate the latter point, I recall a boy I had been seeing with a persistent unexplained accommodation weakness. By chance I learned that he had been

taking antihistamines for a recurrent allergic rhinitis. Antihistamines may cause accommodation weakness. Cessation of the antihistamine therapy led to a return of normal accommodation function.

In a review of the relationship between drugs and accommodation weakness, I found that over 100 drugs may be implicated. On the slide I now project, 122 drugs are cited. The variety of drugs is extensive. The list includes analgesics, antibacterials, sedatives, tranquilizers, antidepressants, antispasmotics, diuretics, antihistamines, and even the so-called "street drugs" such as cocaine, marijuana, and amphetamines. Perhaps some of the discrepancies and inconsistencies encountered in Doctor Mazow's findings an results may be explained not only be placebo effect, but also, at least in some cases, by unrecognized drug use.

Dr Malcom L. Mazow. I appreciate each of the discussants comments. I know this is a controversial subject. I will try to briefly answer the questions that have been asked. Accommodative and convergence insufficiency is a common factor contributing to the diagnosis of dyslexia. Ophthalmology has shunned its responsibility in this area and is important for us to look for accommodative and convergence insufficiency when we are evaluating the patient, with learning difficulty.

Those patients not treated with convergence exercises are individuals who got better with plus lenses. They responded well on their own without the need for convergence therapy. I appreciate Doctor von Noorden's comments because his work was the impetus that stimulated this study. I don't know the answer. We found, though that we could take certain patients out of plus lens in the office and if it worked, we would then decrease the plus lens by the amount found and the effect was sufficient. This management may well be a placebo effect. We may even give a minus lens and have the same effect.

Doctor Guyton brings up a very interesting point of using dynamic retinoscopy to determine objectively the sustaining of accommodation. The medical work-up of these children was noncontributory. With the average age being 11.6 years the past medical history was negative.

Lastly, I reported a patient who developed the accommodative effort syndrome and accommodation broke down each time he smoked marijuana. The drugs mentioned in the discussion should be considered in all children's medical history. It is possible that recreational drugs can create the same problems, so they should also be considered.

Thank each of you for discussing this paper.