5-1985

Monocular estimate method (MEM) of nearpoint retinoscopy in a first and fourth grade population

Rick L. McManus
Pacific University

Mitch R. Fearing
Pacific University

Monocular estimate method (MEM) of nearpoint retinoscopy in a first and fourth grade population

Abstract

Vision screenings are an important first step at identifying those with a visual deficiency. For many school children, these screenings are their first encounter with a vision care specialist. As part of a Pacific University College of Optometry screening of first and fourth graders in the Forest Grove School District, three MEM retinoscopy test conditions were evaluated.

Normative data were collected for these test conditions and were statistically compared to each other and to the Gates-MacGinitie reading test for comprehension at each grade level. The results show that the motor response lag of accommodation for the two grade levels was not significantly different. For both grade levels, selected MEM findings showed a significant difference when comparing those who passed to those who failed the screening based on the modified Orinda criteria. For the first graders, one of the MEM test conditions was found to be informative when evaluating both good and poor comprehension performance on the reading test.

Degree Type

Thesis

Degree Name

Master of Science in Vision Science

Committee Chair

Harold M. Haynes, O.D.

Second Advisor

Alan W. Reichow, O.D.

Subject Categories

Optometry

MONOCULAR ESTIMATE METHOD (MEM) OF NEARPOINT RETINOSCOPY IN A FIRST AND FOURTH GRADE POPULATION

A Thesis Presented to the
Faculty of the Pacific
University College of Optometry
in Partial Fulfillment of
the Requirements for the
Doctor of Optometry Degree

Rick L. McManus
Mitch R. Fearing
Faculty Advisors: Harold M. Haynes, O.D.
Alan W. Reichow, O.D.

May 1985

MONOCULAR ESTIMATE METHOD (MEM) OF NEARPOINT RETINOSCOPY IN A FIRST AND FOURTH GRADE POPULATION

Presented to the faculty of Pacific University College of Optometry in partial fulfillment of the requirements for the Doctorate of Optometry degree.

Authors:

Rick L. McManus

Mitch R. Fearing

Accepted by faculty advisors:

Harold M. Haynes, O.D.

Alan W. Reichow, O.D.

Thesis letter grade: A

May 1985

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

The authors would like to express their sincere appreciation to their advisors Harold M. Haynes and Alan W. Reichow for all their assistance, contributions, and patience throughout this project.

We would like to thank the principals of the Forest Grove School District for their assistance in obtaining the reading test scores, especially Mr. Arleigh Berget of Dilley Elementary for helping with the coordination of the screenings.

Our appreciation to our colleagues Wallace L. Christensen, Bruce G. Cudahy, Sheryl L. Karman, Tami R. Lang, David J. McBride, Alan T. Rees, and Nery C. Sison for their help in completing this project before graduation. We wish them well in their optometric careers.

Our thanks to the Pacific University College of Optometry Screening Program for allowing us to perform our additional tests as part of their screening regimen.

And last but not least a special thank you to our wives, who put up with one more excuse for not spending more time with them. We love you both.

ABSTRACT

Vision screenings are an important first step at identifying those with a visual deficiency. For many school children, these screenings are their first encounter with a vision care specialist. As part of a Pacific University College of Optometry screening of first and fourth graders in the Forest Grove School District, three MEM retinoscopy test conditions were evaluated.

Normative data were collected for these test conditions and were statistically compared to each other and to the Gates-MacGinitie reading test for comprehension at each grade level. The results show that the motor response lag of accommodation for the two grade levels was not significantly different. For both grade levels, selected MEM findings showed a significant difference when comparing those who passed to those who failed the screening based on the modified Orinda criteria. For the first graders, one of the MEM test conditions was found to be informative when evaluating both good and poor comprehension performance on the reading test.

INTRODUCTION

This study reports the results of an expanded visual screening of first and fourth grade school children from the Forest Grove Public School District. Selected clinical tests were added to the routine Pacific University College Of Optometry visual screening to acquire local age and grade level norms and to determine if selected visual tests were statistically related to reading performance as measured by the Gates-MacGinitie reading test for comprehension. This paper will deal with the normative findings of the dynamic retinoscopy and its relationship to the reading test scores.

As vision specialists we are often faced with the task of determining if a child's vision is reducing their ability to perform in a school environment. Visual anomalies have both been blamed and denied as related to reading failures. However, most professionals would agree that the effects of visual anomalies should be considered in individual cases. The issue then is not whether vision is or is not involved with school performance, but rather to what degree.

Research (1) indicates that there is a slightly greater percentage of visual dysfunctions among children with an educational disability than among a normal population. These same studies seem to indicate that visual deficiencies might hamper the child in his ability to read, but this cannot

decisively determine the final outcome. Park (2) concludes that the "peripheral ocular mechanisms" such as ductions, phorias, and accommodative performance are important in determining the relationship of visual deficiencies to reading difficulty. Hoffman (3) took visual measures on 107 children who were referred for optometric care by educators, psychologists and reading specialists. Each of the children had been identified as having a learning problem by the referring professional. These children were compared to a group of 25 children who did not have an identified learning problem. The results suggest that children with learning problems have a higher incidence of the following visual anomalies: binocular coordination, focus facility, ocular motor efficiency, and visual-motor integration.

In Haines' (4) longitudinal study of 37 children over seven years, it was concluded that those children with visual problems during the early school years seemed to have a poor academic beginning from which it was difficult to recover. Flax (1970) (5) suggested that accommodative deficiency is indicated in reading disability, but its relative contribution compared to other factors is unknown. Sohrab (1974) (6) reported improvements in reading comprehension and in the frequency of fixations with optical corrections for the lag of accommodation in a group of below-average readers.

Poynter et al. (1982) (7) looked at the five oculomotor functions of frequency of forward fixations, frequency of regressive fixations, duration of fixation, lag of

accommodation, and lateral vergence as measured by fixation disparity in 74 fourth and sixth graders during both prose and digit reading. The lag of accommodation was measured during grade level prose for each subject (20/75 Snellen) and digit reading (20/120 Snellen). For both grade levels the lag of accommodation for prose and digit reading conditions were found to be positively correlated at the .01 level of significance (7). The lag of accommodation predicted 6-8% of the variance in reading ability. (7) Thus, accommodative posture to basic stimuli was found related to reading ability at both age levels. Age and Verbal Intelligence (as measured by the Peabody Picture Vocabulary Test) did not appear as a significant intervening variable in the relationship between lag of accommodation and reading ability. The individual oculomotor functions that appeared most likely to account for the relationships between oculomotor functions and reading ability were the frequency of forward fixations and lag of accommodation for the fourth graders; and frequency of regressive fixations and lag of accommodation for the sixth grade group. (7)

Nedrow (1970) (1) examined the accommodative performance of 35 fourth graders, taken from a population of 168 fourth graders, selected on the basis of superior and inferior reading performance. The subjects were chosen on the basis of: either sex, an I.Q. score within one standard deviation from the mean, no previous evidence of environmental or physical handicaps, performed either in the top or bottom 25%

of the total population according to the Metropolitan reading and SCAT ability score discrepancy values, a teacher forced sort, and investigator and teacher concurrence on group placement. Each child had a complete optometric refractive routine administered with the examiner unaware of group placement at the time of the examination. The statistical treatment of the accommodative system (through use of Accommodative Index Scores) in this study supports the clinical opinion that disturbed accommodative performance appears more frequently in a poor reader group than the similarly selected good reader group and was statistically supported at the .05 level of significance. (1) Of the individual test sets, the Monocular Estimate Method (MEM) of dynamic retinoscopy was the most indicative of differentiation. Three MEM tests were performed (20/200, 20/50 and 20/20 Sloan letters), with all three showing a definite trend toward lesser accommodative function in the poor reader group. (1) Distance was held constant for all three procedures, the primary stimulus involved was the subtended angular size of the letters and numbers. The reduction in the subtended angle required a more precise accommodative adjustment to meet the discrimination requirements of the task.

DESIGN OF SCREENING

Data were obtained by visually screening 658 first and fourth graders in the seven schools of the Forest Grove school district between April 9 and May 3, 1984. The screening consisted of the Pacific University College of Optometry Vision Screening Battery with additional tests pertinent to the current project included. The screening battery is shown in table 1. The criteria used for determining failure of the screening were modified from those developed by the Orinda Study. These are shown in the starred sections A-E of table 1. The additional tests (sections F-J of table 1) were performed for research purposes by individual fourth year student groups. Our group was involved specifically with the dynamic retinoscopy findings. The screenings were completed just two weeks prior to the administration of the nationally standardized Gates-MacGinitie reading tests. For these reading tests, the NCE (Normal Curve Equivalent) scores for comprehension were used in our correlations.

TABLE 1

PACIFIC UNIVERSITY COLLEGE OF OPTOMETRY VISION SCREENING PROGRAM - CRITERIA FOR REFERRAL

* A. Visual Acuity (Near or Far):	worse than 20/30, either eye
* B. Refractive Error:	
1. Hyperopia	$\geq$ +1.50D
2. Myopia	$\geq$ -.75D
3. Astigmatism	$\geq$ +/-1.00D
4. Anisometropia	$\geq$ +/-1.00D
* C. Two-Eyed Coordination:	
1. At Distance (20 feet):	
a. Tropia	Any tropia
b. Esophoria	$\geq$ 5
c. Exophoria	$\geq$ 5
d. Hyperphoria	$\geq$ 2
2. At Near (16 inches):	
a. Tropia	Any tropia
b. Esophoria	$\geq$ 5
c. Exophoria	$\geq$ 10
d. Hyperphoria	$\geq$ 2
* D. Ocular Health:	Any verified pathology or medical anomaly of eye and/or adnexa
* E. Ocular Pressure (if tested):	
1. Measured IOP (Borderline IOP: 22-25 mmHg)	26 mmHg or greater
2. IOP(right) - IOP(left) (Borderline: 4-5 mmHg)	6 mmHg or greater
F. Near Point of Convergence (NPC):	
1. Break (recorded in inches)	
2. Recovery (recorded in inches)	
G. MEM Retinoscopy:	
1. 20/300 Snellen numbers	
2. 20/30 Snellen letters	
H. Stern-Fixation Test:	
1. Level 1 (First through third graders)	
2. Level 2 (Fourth graders and older)	
I. Lens Rocks (+/-2.00D):	Recorded number of clears in 30 and 60 seconds.
J. Prism Rocks (8 BI/BO):	Recorded number of clears in 30 and 60 seconds.

Table 1: * A-E were used to determine pass/fail criteria. Tests F-J were used in screening study to develop normative data and were not used for referral.

MEM TEST PROCEDURES

MEM retinoscopy was first described by Haynes (1960), was popularized by John R. Pierce (1968), and is currently used in various clinical research studies. (8) Presently, different forms of nearpoint retinoscopy (Book, Bell, Stress point, and MEM) are utilized by practioners. MEM retinoscopy objectively measures the posture of accommodation relative to the fixation plane. The dioptric discrepancy between the accommodative stimulus and the accommodative response is called the motor response lag of accommodation (MRLa).

Being an objective technique, the MEM finding is limited only by the examiners skills. This method differs from "book" retinoscopy in that large amounts of off-axis and eye to task distance errors are eliminated by mounting the target on the retinoscope rather than scoping over the top of a book. It has been demonstrated that off-axis retinoscopy induces substantial error in interpretation when more than five degrees from the visual axis. (9-11)

For the purpose of this study, MEM was performed with the child wearing no glasses or their habitual glasses. The child was seated comfortably in a well-lit room with the examiner on his/her midline and below the level of the child, such that the eyes were in a moderate down-gaze to approximate a normal reading posture. The working distance

was held constant at 40 cm. with a string attached to the retinoscope, the other end of the string being held by the child to his/her chin. Though a child aged six to nine years has a working distance of approximately 25 to 33 cm. (10-13 inches), the longer test distance was used for the purpose of norming the results. Other researchers have proposed performing this test at the childs normal working or Harmon distance to approximate his usual accommodative demand. (8) However, as Haynes has pointed out, the 40 cm. distance is less apt to be affected by small changes in examiner working distance since the accommodative response is a linear function over the accommodative stimulus range of 20 to 67 cm. (12) Thus, as a result of the linear accommodative response/stimulus relationship, the findings are easily transposed.

The target was constructed of a hole card (1/2"dia.) with printed material within (1/2") of the hole to avoid any induced off-axis optical effects. (13) (Figure 1) The card consisted of five numbers of 20/300 Sloan acuity demand around the superior half of the hole and a block of 20/30 Sloan acuity letters placed inferiorly (given a 40 cm. working distance). The hole card was attached to the handle of the retinoscope with a clip which held it firmly against the face of the scope.

Grade level reading material was considered for use in this study but not included since the purpose of doing MEM was to evaluate the accommodative response for a specific

FIGURE 1

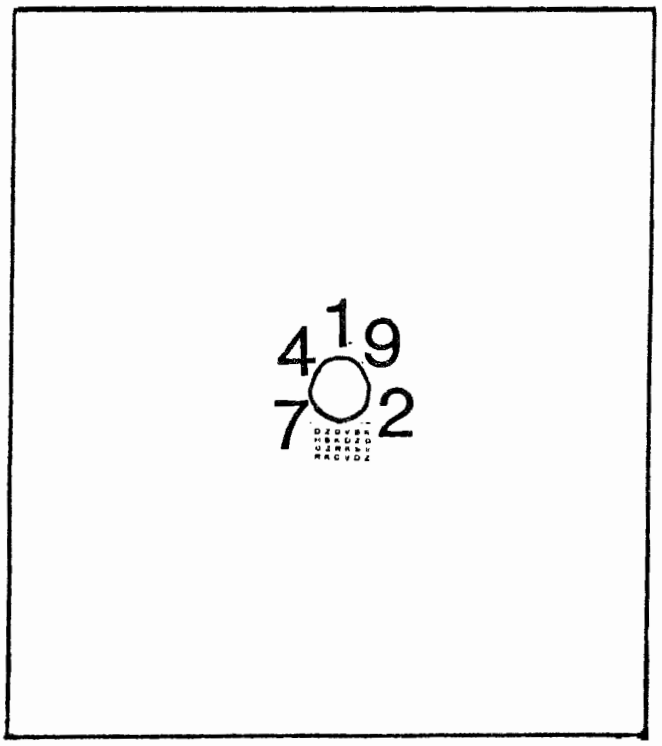


Figure 1: This is the MEM card used to obtain all measurements. The five numbers surrounding the superior portion of the center 1/2" hole subtend 20/300 visual acuity. The block of letters inferiorly subtend 20/30. All testing was performed at 40 centimeters.

letter and number reading task without complicating the analysis with comprehension variables. Numbers and letters were placed on the same card so that one test card could be used for the purpose of screening with 20/300 and 20/30 targets. (14)

There are many ways of defining the nondominant eye. In this study the results of the near point of convergence (NPC) were utilized. NPC break and recovery findings were performed by the same examiners who performed MEM. The eye which deviated first was considered the nondominant eye. If the child's break point was to the nose, the subject was asked which hand they used for writing. That hand was considered the dominant hand and the corresponding contralateral eye the nondominant eye.

Once seated the child was asked; "Can you read the big numbers on my card?" The test was then explained; "I am going to be flashing this light in front of your eyes and I want you to start at the top and read each of the numbers outloud". Initially the examiner placed the vertical streak on the childs nose, then swept both eyes and estimated the motion. If the child finished reading the numbers before the measurement had been made he was instructed to repeat. If a detectable anisometropia (>.50D) was noted, "ANISO" was recorded and both eyes neutralized. If a detectable cylinder was noted, "CYL" was recorded and the nondominant eye neutralized. If neither "ANISO" or "CYL" were noted the nondominant eye was neutralized by rapidly interposing lenses

at the spectacle plane as the streak moved across the eye. This monocular measurement is made quickly so as to minimize the effect of the measuring lenses. (12) This method is also an attempt not to disturb the binocular accommodative response nor interfere with binocular fixation.

After estimating and neutralizing the motion produced by fixation of the 20/300 Sloan numbers, the child was asked to orally read the block of 20/30 Sloan letters and the same procedure as used for the numbers repeated. If accommodation was significantly receded from the plane with the numbers (greater than +1.50), it was rechecked following measurement with the letters. The neutralizing lenses were placed in two separate flippers, one containing -.25D, +.25D, +.50D, and +.75D. The other flipper contained lenses of +1.00D, +1.25D, +1.50D, and +1.75D. When the lens needed to neutralize the motion was greater than +1.75D or more minus than -.25D, an auxiliary flipper containing -1.00D, -.50D, +2.00D, and +2.50D lenses was used. Whenever the accommodative response fell between these lens powers, the motion was estimated.

RESULTS

A total of 658 children were screened, of these, 162 or 25% failed the screening criteria. Of the 658 subjects, a full battery of research findings were obtained on 566. Statisical analysis were performed using this lower number. For purposes of evaluating the results of the MEM findings the first and fourth graders were divided into two groups, those passing the screening criteria and those who failed. See Table 1 for pass/fail criteria.

Table 2 displays the statistical results for the number and letter reading conditions of the MEM retinoscopy for the first and fourth graders who either passed or failed the screening criteria. The mean, mode, median, standard deviation, and range are listed for each.

Statistical significance was set at the five-percent confidence level. The t-test for nonpaired sampling was used to determine differences between means and the F test was used to test differences in variance. The results of these tests are shown in Table 3. This result indicates that there is no statistically significant difference between first and fourth graders for all three of our MEM conditions. The distribution of the MRLa for first and fourth grade students are indistinguishable. Graph 1 illustrates this point for the 20/30 letter reading task.

. Graph 2 shows the 20/300 Number reading results of the

TABLE 2

DESCRIPTIVE STATISTICS OF MEM FINDINGS FOR THOSE WHO PASSED AND THOSE WHO FAILED THE GENERAL SCREENING CRITERIA.

		1st Pass (N=287)	1st Fail (N=39)	4th Pass (N=196)	4th Fail (N=44)
MEM N	Mean	+.82	+1.03	+.73	+.85
(20/300)	Mode	+1.00	+.50	+.75	+.75
	Med	+1.00	+1.00	+.75	+1.00
	S.D.	.45	.88	.46	.99
	R	-.50-+2.25	-.50-+5.00	-.50-+2.50	-1.25-+3.75
MEM L	Mean	+.47	+.50	+.43	+.32
(20/30)	Mode	+.50	+.50	+.25	+.75
	Med	+.50	+.75	+.50	+.50
	S.D.	.40	.61	.37	.63
	R	-1.00-+2.00	-.75-+2.50	-.75-+1.50	-1.00-+2.00
MEM N-L	Mean	+.36	+.53	+.30	+.53
	Mode	+.25	+.25	+.25	+.25
	Med	+.50	+.50	+.50	+.50
	S.D.	.31	.80	.29	.78
	R	-.75-+1.50	-.25-+5.00	-.50-+2.00	-.50-+4.00

Table 2. Table 2 displays the mean, mode, median (Med), standard deviation (S.D.), and range (R) of the MEM findings in neutralizing lens powers for those children who either passed or failed the general screening criteria as listed in sections A-E of Table 1.

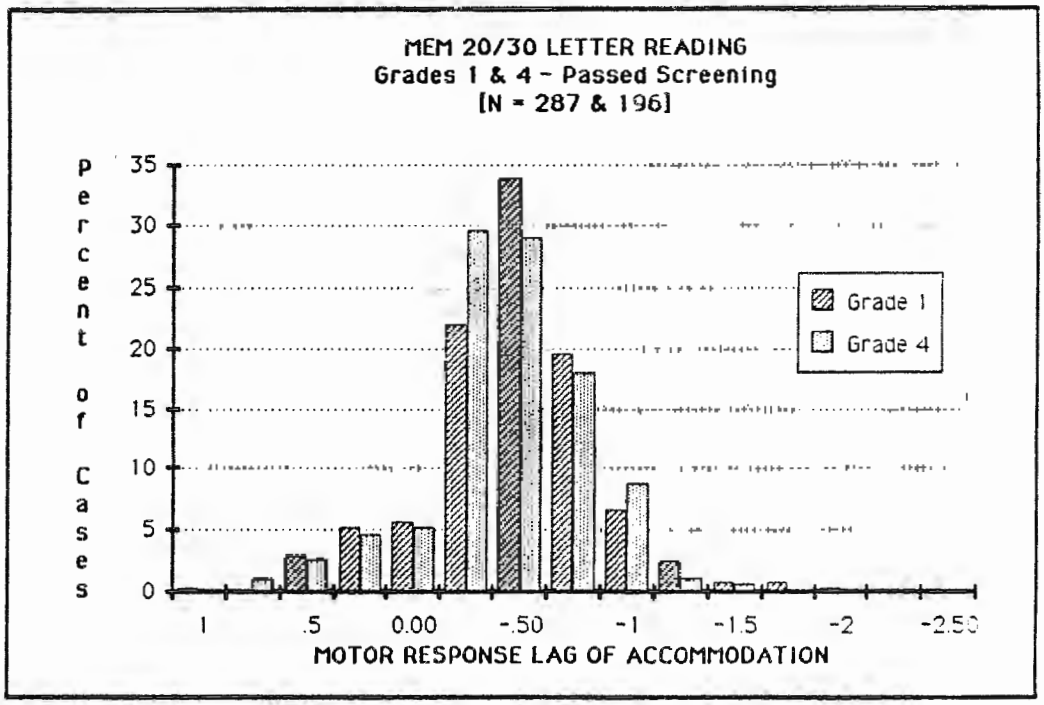
TABLE 3

RESULTS OF t-TESTS AND F-TESTS.

	t-test	F-test
MEM NUMBERS (20/300):		
1st passed vs. 1st failed	p=.0251	p < .005
4th passed vs. 4th failed	p=.5144	p < .005
1st passed vs. 4th passed	p=.3866	p > .250
1st failed vs. 4th failed	p=.3937	p = .250
MEM LETTERS (20/30):		
1st passed vs. 1st failed	p=.6662	p < .005
4th passed vs. 4th failed	p=.0603	p < .005
1st passed vs. 4th passed	p=.6869	p > .250
1st failed vs. 4th failed	p=.1806	p > .250
MEM NUMBERS-LETTERS:		
1st passed vs. 1st failed	p=.0122	p < .005
4th passed vs. 4th failed	p=.0060	p < .005
1st passed vs. 4th passed	p=.2211	p = .250
1st failed vs. 4th failed	p=.3843	p > .250

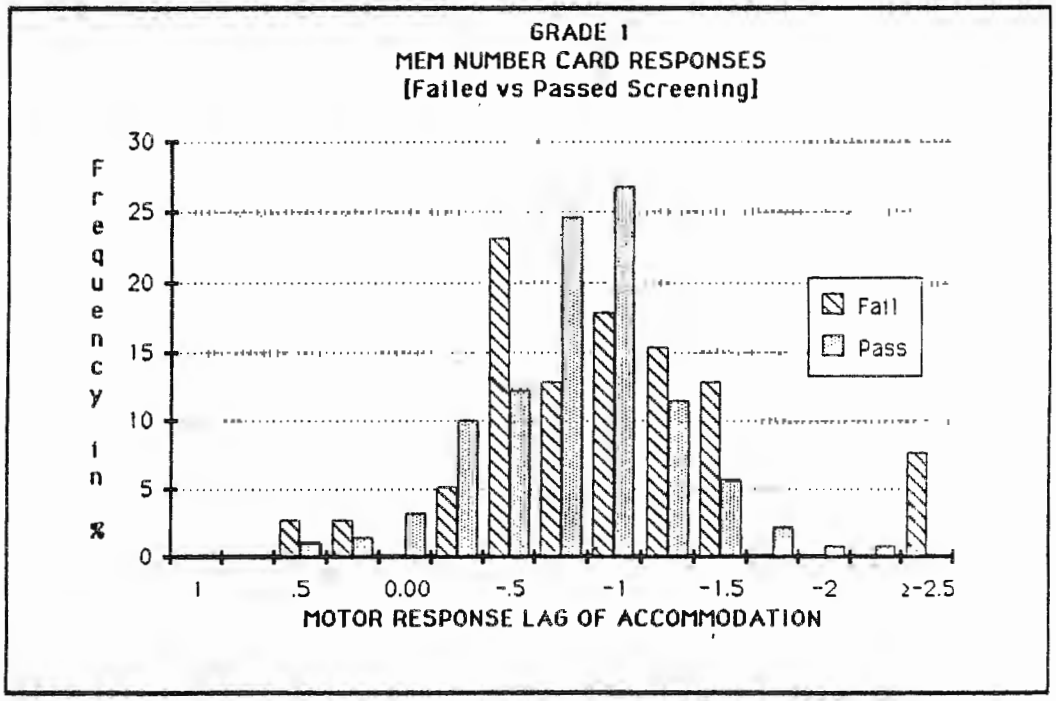
Table 3. Table 3 displays results of t-tests (difference between means) and F-tests (difference between variance or standard deviation) for the groups indicated. Passed or failed above refers to sections A-E of the general screening criteria as listed in Table 1.

GRAPH 1



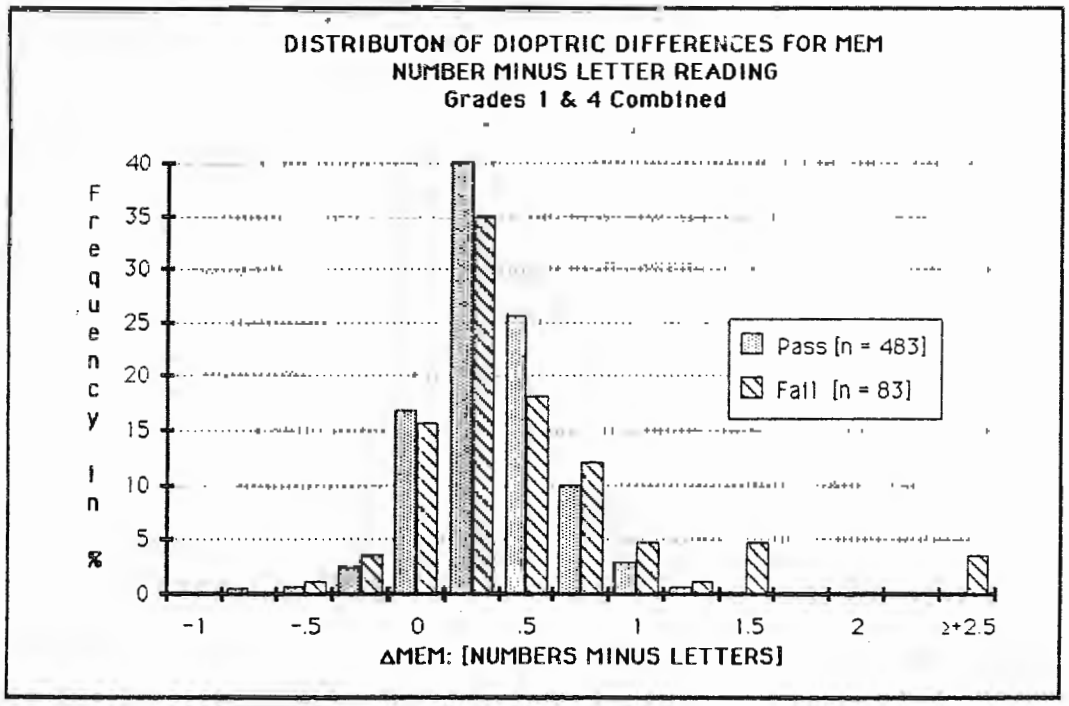
Graph 1. Comparison on the MEM 20/30 letter reading task of first and fourth graders who passed the general screening. The two grade levels are indistinguishable.

GRAPH 2



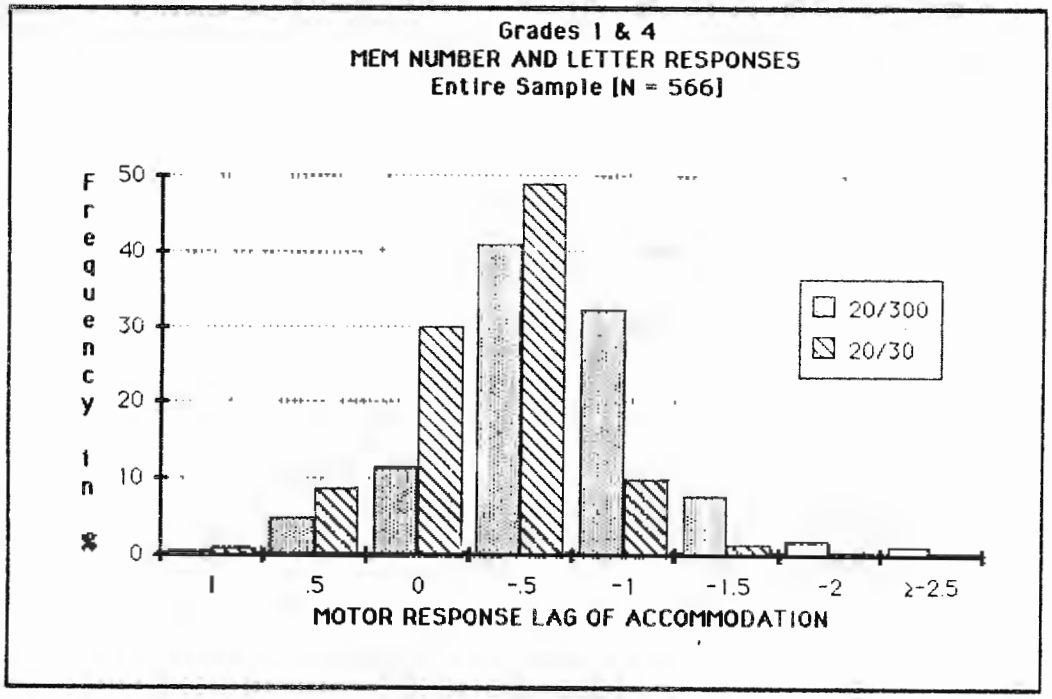
Graph 2. Comparison on the MEM 20/300 number reading task of first graders who passed and those who failed the general screening criteria. Differences between groups are statistically significant.

GRAPH 3



Graph 3. Illustration of the dioptric difference obtained by subtracting the letter reading response from the number reading task for the two grade levels combined. The graph compares those who passed to those who failed the general screening criteria.

GRAPH 4



Graph 4. Graph 4 displays the 20/300 number and 20/30 letter responses for all children screened. Approximately 10% of the children screened had a motor response lag of accommodation outside of the normal range as described by Haynes. (16)

first graders who passed versus those who failed the general screening criteria. Results are statistically significant. This result indicates that the variance of the MRLa is greater for those children failing the screening criteria.

Graph 3 displays the algebraic difference obtained by subtracting the letter reading response from the number reading task for the first and fourth graders combined. The differences demonstrate the change in accommodative response resulting from oral reading of 20/300 numbers and 20/30 letters.

MEM intertest correlations for the first graders who passed the screening show that there is a moderate correlation, r =.771, between MEM (20/300) numbers and MEM (20/30) letters. When the MEM numbers findings are compared to the algebraic difference between number and letter responses (MEM N-L) a somewhat weaker correlation exists with r =.498. When MEM letters and (MEM N-L) findings are compared, an r value of .168 is obtained which is not significant. These statistical results are fully in accord with clinical experience.

Looking at the fourth graders who passed the screening shows the same trend with MEM numbers and MEM letters moderately correlated (r =.739). Likewise, MEM numbers and (MEM N-L) shows a moderate correlation (r =.615). Again as with the first graders, MEM letters and (MEM N-L) is not significant (r =.040) and are at the chance level.

The Chi-squared method of analysis was used to compare

the three MEM measurements to the Gates-MacGinitie reading test for comprehension. For purposes of comparison the bottom and top 25 percentiles in each group were utilized. The first graders showed a significant relationship between MEM numbers and reading comprehension, with a critical value at the .025 level. Fourth graders did not show a significant relationship between any of the three MEM findings and the reading comprehension scores.

DISCUSSION OF RESULTS

The visual screening of first and fourth graders in the Forest School District was valuable for many reasons. The most important was that 162 children or 25% of the population screened did not meet the modified Orinda screening criteria used for referral purposes. All 162 children were referred for further testing and or treatment to correct a possible visual anomaly.

Secondly, the screening provided large numbers of similiarly aged children for which MEM test norms could be established. The means for the MEM numbers test for those first and fourth graders who passed the screening criteria, as shown on Table 2, agree with work previously reported by Haynes. (12) Those children who failed the screening tended

to have a higher than normal motor response lag of accommodation. The MEM letters and (MEM N-L) are new tests without previously standardized norms. It was important that norming statistics be established for these tests so that comparisons could be made with other findings taken in future screenings.

Table 3 shows results of t-tests and F tests performed on the various findings. Comparing the first graders as a group to the fourth graders shows that there is no significant difference between the two groups for all three MEM conditions. Graph 1, which compares first graders and fourth graders on MEM Letter test performance, illustrates this point. This is not a surprising finding in that Haynes et al, (16) has reported that the accommodative lag approximated adult levels by the age of four months. When first and fourh graders are combined into one group and the results of MEM numbers analyzed, approximately 10% of the children have a motor response lag of accommodation outside the normal range as described by Haynes. (16) This is illustrated in graph 4.

The mean and variance for those who failed the screening criteria are significantly different from those who passed for MEM numbers and (MEM N-L) in first graders and (MEM N-L) in fourth graders. (see Table 3) These differences can be better appreciated visually on Graphs 2 and 3. Graph 3 combines first and fourth grade results on the (MEM N-L) test. These results indicate that there is a tendency toward

an accurate prediction of failure of the screening criteria based on the findings of MEM numbers and (MEM N-L) tasks for first graders and the (MEM N-L) task for fourth graders. The present screening criteria fail to identify a large number of children with an accommodative dysfunction. This supports the addition of these MEM tests to the routine visual screening battery.

F test results indicate a significant difference in all three MEM findings between those who failed and those who passed the screening criteria for both first and fourth graders. This indicates that although the means might be similar for the two groups, dispersion of scores around the mean are significantly different. This result shows that the standard screening criteria do identify a substantial number of children which would fail an MEM screening standard. Conversely, many children with an excessive motor response lag of accommodation are not identified by the screening battery used in this study.

When looking at MEM intertest correlations, MEM numbers shows a substantial correlation with MEM letters ($r = 0.77$ for first graders and $r = 0.74$ for fourth graders) which indicates these two findings tend to vary covariantly. A large motor response lag of accommodation finding on the MEM numbers generally is found associated with a higher value on the MEM letter reading task. These findings show that the change in accommodative response between large and small letters and digits cannot be predicted from the 20/30 letter

target retinoscopic observation. Both target sizes are required.

In the past it has been shown that one visual finding in and by itself does not predict poor reading ability in an individual. (7) This is the case for most of the individual MEM test findings when compared to the Gates-MacGinitie comprehension reading scores. However, the MEM numbers test for the first graders, when looking at the bottom and top quartiles with the Chi-square shows a relationship with a critical value of .025. This suggests that there is a tendency toward poor reading ability in the first grader who has a poor MEM numbers finding. The converse is also true that good reading ability in first graders showed good MEM Number performance. This statistical relationship was not found at the fourth grade level. These results indicate that the Gates-MacGinitie reading test result can not be used to differentiate those children with an accommodative dysfunction when visual acuity at near is better than 20/30.

SUMMARY

The screenings of the first and fourth grade students in the Forest Grove school district was a very valuable experience for both the children and the interns involved. For many of the children it was their first direct contact with a vision care specialist. The informal atmosphere of the screening helped to encourage the children to ask questions and learn more about their vision. Furthermore, those children who did not pass the screening criteria and were referred for further testing could feel less apprehensive of future visual examinations due to the manner in which they were treated during the screening.

The screening was also important to the interns involved. It offered the opportunity to examine a large number of very young patients, perfect diagnostic techniques, and develop the skills needed to communicate effectively with this age group. This exposure will undoubtly help the intern to better deal with this age group in future years of clinical practice.

Normative data were acquired for tests which are currently used in the Pacific University College of Optometry Vision Therapy Clinics. Performance relative to age was determined and found to be similar at the first and fourth grade levels.

Although the MEM numbers was significant at determining

low and high performance on the Gates-MacGinitie reading test for the first graders, a majority of the MEM conditions did not show a significant relationship to the performance scores. The lack of a strong relationship could be attributed to an inability to control for the distance refraction during MEM testing. Refractive errors of -.75D to +1.50D were considered "emmetropic" in our screening and obviously confounded the results. The results indicate that a battery of accommodative tests are necessary if one is to identify an accommodative dysfunction sufficiently to interrelate to a reading test such as the Gates-MacGinitie. The Nedrow (1) study, which controlled for the distance refraction, used Accommodative Index Scores to show that a group of poor readers was statistically related to disturbed accommodative performance.

The data clearly show that the MEM test conditions utilized in this study are excellent for identifying children with an accommodative dysfunction which should receive professional evaluation. The monocular estimate method of dynamic retinoscopy could add a significant dimension to visual screenings.

REFERENCES

1. Nedrow JL. A comparative study of accommodative performance in a selected group of good and poor readers. Master of science dissertation, Pacific University, Forest Grove, Oregon, 1970.

2. Park GE. Reading difficulty (dyslexia) from the ophthalmic point of view. Am. J. Ophth. 1948; 31:28-34.

3. Hoffman LG. Incidence of vision difficulties in children with learning disabilities. J. Am. Optom. Assoc. 1980; 51(5): 447-451.

4. Haines H. An evaluation of the visual stress and academic acheivement of a selected group of elementary children over a period of seven years. Am. J. Optom. Arch. Am. Acad. Optom. 1955; 32:279.

5. Flax N. Problems in relating visual function to reading disorder. Am. J. Optom. Arch. Am. Acad. Optom. 1970; 47:366-72.

6. Sohrab G. Eye movement patterns and reading performance in poor readers, immediate effects of convex lenses indicated by book retinoscopy. Master of science dissertation, Pacific University, Forest Grove, Oregon 1974.

7. Poynter HL, Schor C, Haynes HM, et al. Oculomotor functions in reading disability. Am. J. Optom. Arch. Am. Acad. Optom. 1982; 59(2):116-127.

8. Bieber JC. Why nearpoint retinoscopy with children? Optom. Wkly. Jan. 1974:23-26.

9. Fry GA. Factors contributing to the discrepancy between subjective and skiascopic determination of the refraction of the eye. The O-Eye-O, 1949; 15:3.

10. Copeland JC. The refraction of children with special reference to retinoscopy. Diag. Proc. Ped. Ophth. I.O.C., 1963; 3:4.

11. Haynes HM. Clinical observations with dynamic retinoscopy. Optom. Wkly. 1960; 51:2243-6, 2306-9.

12. Haynes HM. Lectures in Optometry III: Advanced case analysis and motor dysfunction, Pacific University College of Optometry, Forest Grove, Oregon, Fall 1983.

13. Greenspan SB. M.E.M. retinoscopy. The Refraction Letter, December 1974.

14. Haynes HM. Personal communication. Forest Grove, Oregon, Spring 1984.

15. Rouse MA, London R, Allen DC. An evaluation of the monocular estimate method of dynamic retinoscopy. Am. J. Optom. Physiol. Optics. 1982; 59(3): 234-239.

16. Haynes HM. Visual accommodation in human infants. Science, 1965; 14(4): 528-530.