THE EFFECTS OF THE TRIAL LENS
IN
THRESHOLD AUTOMATED PERIMETRY

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November 1990

Abstract

Fourteen normal dilated right eyes were tested using a custom designed threshold test of the Humphrey Visual Field Analyzer (Humphrey Instruments, San Leandro, California) to determine the importance of the trial lens used as the add. Two factors used to determine the importance of the add were test reliability and retinal sensitivity. The custom designed program consisted of eleven randomly chosen points in the central thirty degrees of the visual field. The program was performed five times on each subject, once using the suggested value for the add, and then above and below this null point in 2.00 diopter steps. This study indicates that both reliability and overall retinal sensitivity are decreased when an improper add is used.

Introduction

Automated perimetry has been increasing in popularity over the last decade. Interpreting the results of such tests has been widely discussed and debated. While correct interpretation is obviously important, obtaining a reliable test result must be the first concern. Optimum conditions and procedures are published by Allergan Humphrey, the manufacturer of the Humphrey Visual Field Analyzer. One of the testing condition variables is the

trial lens used as the add for dilated patients taking the test. This study was conducted to determine the importance of using the correct trial lens in determining reliability of the test result and variance in retinal sensitivity.

Subjects and Methods

Fourteen normal right eyes were tested using a custom designed threshold program of the Humphrey Visual Field Analyzer. Visual acuity of all fourteen subjects was 20/20 or better. Intraocular pressures were less than 20mmHg. All subjects had a negative family history of glaucoma. Refractive errors ranged from +1.50 to -7.50 diopter spheres with cylinder values from zero to -1.50. The cylinder was corrected according to the directions of the manufacturer and kept constant during all five tests. Twenty minutes prior to testing, subjects were administered one drop of 1% tropicamide to create presbyopic conditions, and one drop of 2.5% phenylephrine to enhance the dilation. Pupil diameters at testing time ranged from seven to ten millimeters. Ages of the subjects ranged from ten to thirty-nine years with a mean age of twenty-four. Eighty-six percent of the subjects were twenty-six years or younger.

The custom designed test consisted of eleven randomly chosen points in the central thirty degrees of the visual field (Figure 1). Threshold values of these points were determined and recorded. The test was performed five times on each subject, once using the suggested add lens, and then again using adds above and below the suggested add in 2.00 diopter steps.

These lenses were presented in random order for each subject. The average time for one test was two minutes and forty-two seconds. The suggested add was determined by using the subject's refractive error and adding +3.00 diopters due to the presbyopic conditions following dilation. This determination was made using the age table given by Allergan Humphrey where +3.00D adds were given to any patient fifty-five years or older.[1]

The perimetrist was present during all five lens tests to monitor eye position and fixation. This was accomplished by using the eye monitor which displays the subject's eye on the test screen.

To determine the reliability of the test results, criteria developed by Allergan Humphrey were used. Factors that indicate the reliability of any particular point include fixation losses, false positive and false negative errors, fluctuation, and any information concerning the patient that the perimetrist feels is significant to the outcome of the test.[1]

The first criterion is fixation losses. The number of fixation losses is determined by first plotting the blind spot, then randomly presenting stimuli inside the blind spot. If the subject reports seeing a stimulus presented in the blind spot, a fixation loss is recorded. If the fixation loss ratio is twenty percent or greater, the test is considered unreliable. The second criterion is false positive errors. To determine a false positive error, the projector system of the autoperimeter moves as if it were to present a stimulus, but none is presented. If the subject reports seeing the stimulus, a false positive

response is recorded. False negatives are the third criterion. They are determined by presenting a stimulus at a higher intensity than a previously seen stimulus. If the subject does not respond, a false negative is recorded. False positive or negative ratios of thirty-three percent or greater indicate an unreliable result.

The last two criteria are fluctuation and any information the perimetrist feels noteworthy regarding the patient's performance. When the fluctuation test is utilized (it is an optional feature), threshold sensitivity is tested twice in ten predetermined locations. If the patient is consistent, a low fluctuation value is recorded. If a high value is noted, this may indicate early visual field defects or simply that the patient is inattentive or does not understand the test. Examples of information about the patient that the perimetrist may feel is important include general confusion, decreased attention span, decreased alertness and any physical condition that may exist such as weakness, hand tremors or arthritis. Fluctuation was not utilized for this study. Patient information for all study subjects was not a factor.

Retinal threshold sensitivity values are measured in decibels or tenths of a log unit.[2] Since light sensitivity follows a logarithmic pattern, calculations involving averages are based upon the geometric mean, which is the sum of the logarithmic values divided by the sample size.[2]

For each lens value, decibel amounts were averaged for each corresponding point. After compiling each individual point for a

given lens the average of all eleven points was computed. These values were then compared to the averages for the other lens values (Table 1). The null point average was used as the basis for comparison and thus was assigned a one hundred percent sensitivity value. Percentages for the other lens averages were then calculated based on their numerical difference from the average null point value (Figure 2).

Results

The results of this study indicate that both test reliability and retinal sensitivity for normal patients decrease if any lens other than the suggested add was used (Table 1). The largest amount of errors in the reliability criteria was fixation losses (Table 1). It can also be seen in Table 1 that no tests were considered unreliable based on false positive or false negative criteria when the null point lens was used.

The largest decrease in sensitivity occurred with the +4.00D lens. The decrease at the +4.00D level was 21.78% below the null point average, whereas the decrease at the -4.00D level was only 7.09%, almost a three times difference between equal amounts of plus and minus power (Figure 2).

The manufacturer classifies a visual field defect as a variability of 4 decibels or more between adjacent points.[3] While this issue was not addressed in this experiment, it can be assumed that since test reliability and overall retinal sensitivity decreased with any add power tested except the null

point, it would be unwise to use varying add powers if consistent test results are desired. This data stresses the importance of using the correct +3.00D add for any patient that has been dilated with a pharmaceutical agent that creates presbyopic conditions.

Summary

The data from this experiment shows that both reliability and sensitivity decrease if an improper add is used. These evident decreases suggest that using the correct add is mandatory in obtaining valid results. Tests obtained using improper adds cannot be confidently compared to determine if a visual field defect has occurred.

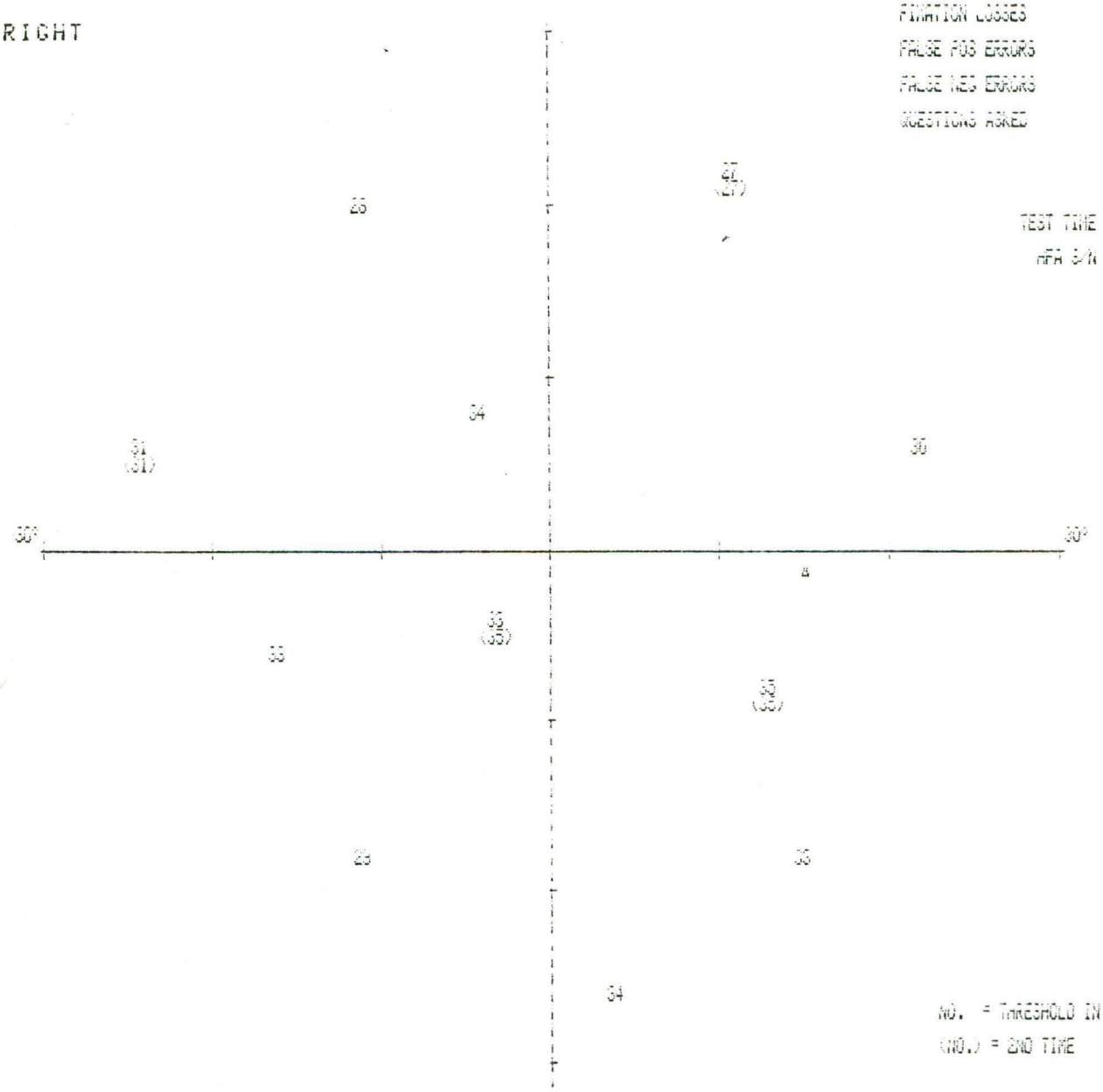
S-A THRESHOLD TEST

STIMULUS III, WHITE, BCKGND 31.5 ASB NAME
BLIND SPOT CHECK SIZE III SPACING 4° ID BIRTHDATE
FIXATION TARGET CENTRAL DATE 06-06-90 TIME 07:25:10 PM
STRATEGY FULL THRESHOLD PUPIL DIAMETER VA
RX USED DS DCX DEG

RIGHT

FIXATION LOSSES	0/6
FALSE POS ERRORS	0/0
FALSE NEG ERRORS	0/1
QUESTIONS ASKED	73

TEST TIME	00:02:03
HFA S/N	530-4559



NO. = THRESHOLD IN DB
(NO.) = 2ND TIME

GRAYTONE SYMBOLS

SYM									
ASB	.8 to .1	2.5 to 1	8 to 3.2	25 to 10	79 to 32	251 to 100	794 to 316	2512 to 1000	7943 to 3162	≥ 10000
DB	41 to 50	36 to 40	31 to 35	26 to 30	21 to 25	16 to 20	11 to 15	6 to 10	1 to 5	≤0

ALLERGAN HUMPHREY
REV AC

FIGURE 1

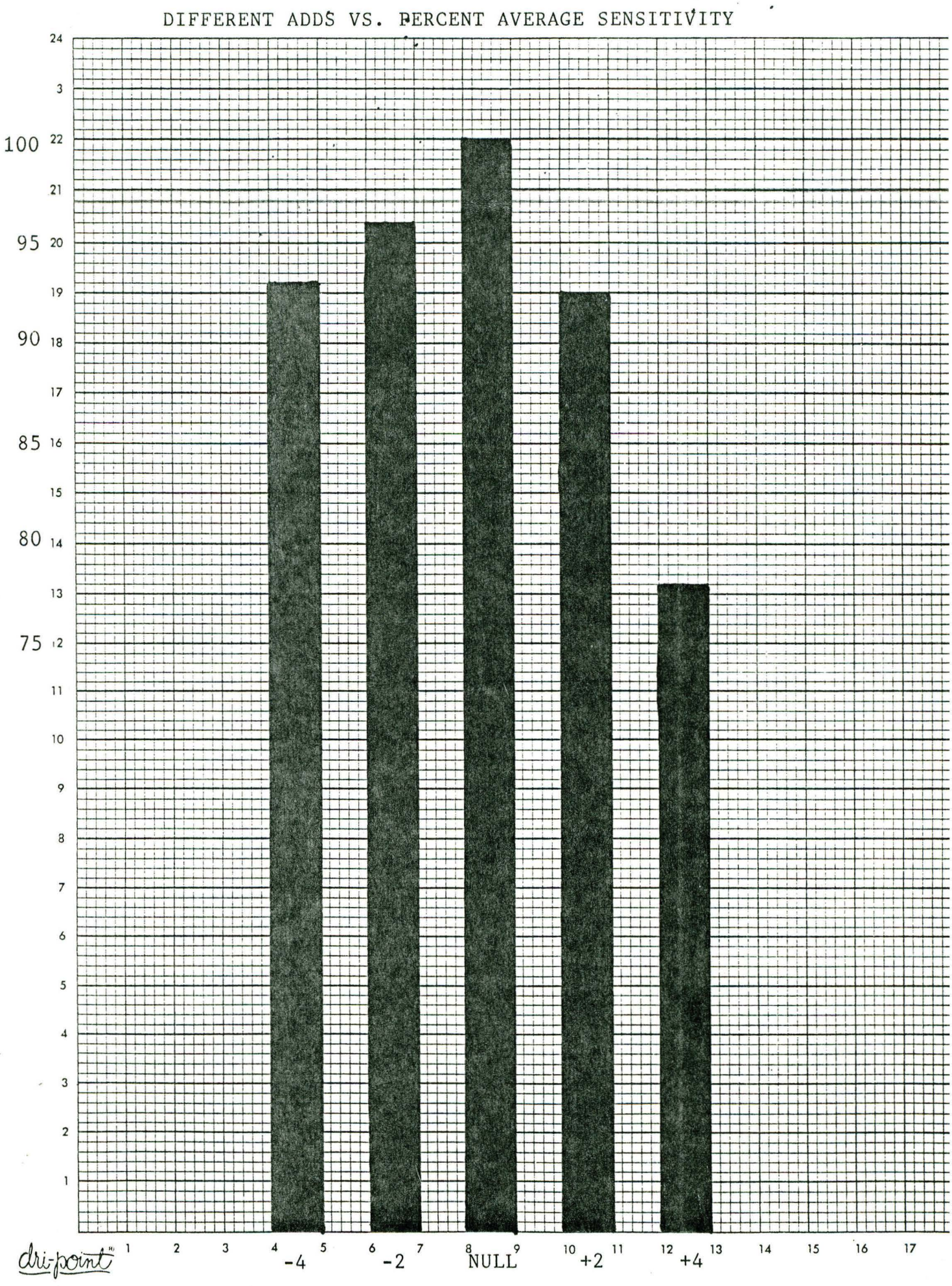

DIFFERENT ADDS VS. PERCENT AVERAGE SENSITIVITY
100
95
90
85
80
75
-4
-2
NULL
+2
+4
dri-point®

FIGURE 2

	Fixation Losses	False Positives	False Negatives	Average Sensitivity (dB)
-4	3	2	2	27.52
-2	5	-	1	28.52
NULL	3	-	-	29.62
+2	3	1	2	27.33
+4	6	2	1	23.17

TABLE 1. Fixation losses, false positive and false negative numbers indicate the number of tests out of fourteen tests for each lens power that were unreliable according to manufacturer criteria levels.

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