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Comparison of the one meter tangent field to critical fusion frequency field on patients showing a visual field defect

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Abstract

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COMPARISON OF THE ONE METER TANGENT FIELD TO CRITICAL FUSION FREQUENCY FIELD ON PATIENTS SHOWING A VISUAL FIELD DEFECT

CLINICAL YEAR THESIS

BY

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1961

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TABLE OF CONTENTS

STATEMENT OF THE PROBLEM

It is the purpose of this study to correlate the findings of the C.F.F. Fields to internal pathology of the eye as expressed or determined by central visual fields.

IMPORTANCE OF THE STUDY

The importance of the study lies in the area of clinical procedure and practice. We shall attempt to determine the feasibility of C.F.F. Field studies as a means of early detection of pathology as applied by the individual practioner.

REVIEW OF THE LITERATURE

Many studies have been made of the effects of disease processes on the critical fusion frequency (C.F.F.). Phillips studied the effects of intracranial tumors on the C.F.F. In 1933 Phillips made the first study of flicker fields on patients. He restricted his tests to 17 areas of the visual field, and even today his targets are considered adequate and his controls good. He found that 2.5 cm. targets gave a central flicker fusion frequency (F.F.F.) of 43 flashes per second, with gradual decrease toward the periphery, while similar 3.5 cm. targets gave a central F.F.F. of 49, with increase in 10-degree peripheral intervals to 56, 50, 44, and 41. He found a decrease in F.F.F. in eight chiasmal and two parietal brain tumors. The two parietal cases had normal visual acuity and fields.

Miles[1] states that the eye is more sensitive to F.F.F. in the periphery (10^{o}-30^{o}) than centrally, and F.F.F. is therefore more likely to detect defects from diseases which effect the peripheral fields first.

According to Miles[2] F.F.F. involves not only local rod and cone function but is influenced by the interaction of various parts of the retina and optic pathway. From the rod free area, it is low, due to greater visual image persistence. It is much higher from the peripheral retina. Phillips[3], Werner[4] and Enzer[5] found decrease in F.F.F. in patients with normal acuity and fields who had brain lesions.

Lindberg, Jamieson, Bowden, and Furie[6] in their thesis found that the greatest sensitivity to flicker at the central fixation

point, followed by decreasing sensitivity at each of the 10, 20, and 30 degree intervals respectively. The lowest sensitivity area is found at the superior 30° visual field.

One of the prime considerations of our study was the early detection of glaucoma. Miles[1] utilized his C.F.F. techniques in two cases of glaucoma. On case "A" ordinary fields were normal in the periphery but showed typical central scotomas. The flicker fields were depressed generally 15 to 20 flashes per second and there were large sector and arcuate defects. In case "B" the C.F.F. fields were slightly depressed peripherally and there was baring of the blind spot.

Miles[7] also showed that if the C.F.F. fields are taken on a perimeter, (i.e. target at constant distance from the eye) the frequency does not drop off as abruptly in the periphery as it does on tests on the tangent screen. Futhermore Miles conducted C.F.F. fields on patients who show definite scotomatous areas with normal fields method. His general conclusions were that C.F.F. fields in this type of patient show a general overall depression.

SOURCE OF DATA, METHODS, INSTRUMENTATION AND PROCEDURE

All of the patients in this study were obtained from the Pacific University Optometric Clinic. Most of these patients had been used in a previous study by Bonde, Gilmore, and Bostwick[8] wherein they correlated the G-11 multiple target screener to standard central field studies. These particular patients all displayed definite field defects.

In each case our routine consisted of plotting of the visual fields on the one meter tangent screen and a C.F.F. field study.

A portable stroboscope (manufactured by the General Radio Corporation, Cambridge 39, Mass.) was used in the C.F.F. study. It is called the "Strobotac". Previous adaptation of the stroboscope used was accomplished by removing the flash tube and the reflector, and soldering the ends of a six foot, form wire cable to the lugs on the flash tube socket. The four prongs of the flash tube itself were then soldered to the appropriate wires of the cable. The last two or three feet of the cable were passed through a rigid metal tube or rod to form a wand by means of which the light can be controlled in its movement in front of the tangent screen. The bulb (flash tube) was then enclosed by a discarded retinoscope handle with a 24 mm. circular opening over a portion of the bulb. This opening was covered with translucent paper (tea bag material) to diffuse the light.

The patient was seated one meter away from a one meter black tangent screen. The wand was held at the center of the tangent screen and the patient was shown what was meant by

flicker. Flicker rate was t en increased until the light appeared continuous and then the F.F.F. decreased until flicker was first perceived at which time he was to signal by tapping. While taking the center reading the patient looked at the wand, but for all other readings, fixation remained at the screens central fixation point. The test was performed in a room of seven foot candles illumination while the patient had the unexamined eye occluded. It should be mentioned at this point that the standard technique for light adaptation of the eye under test was used.

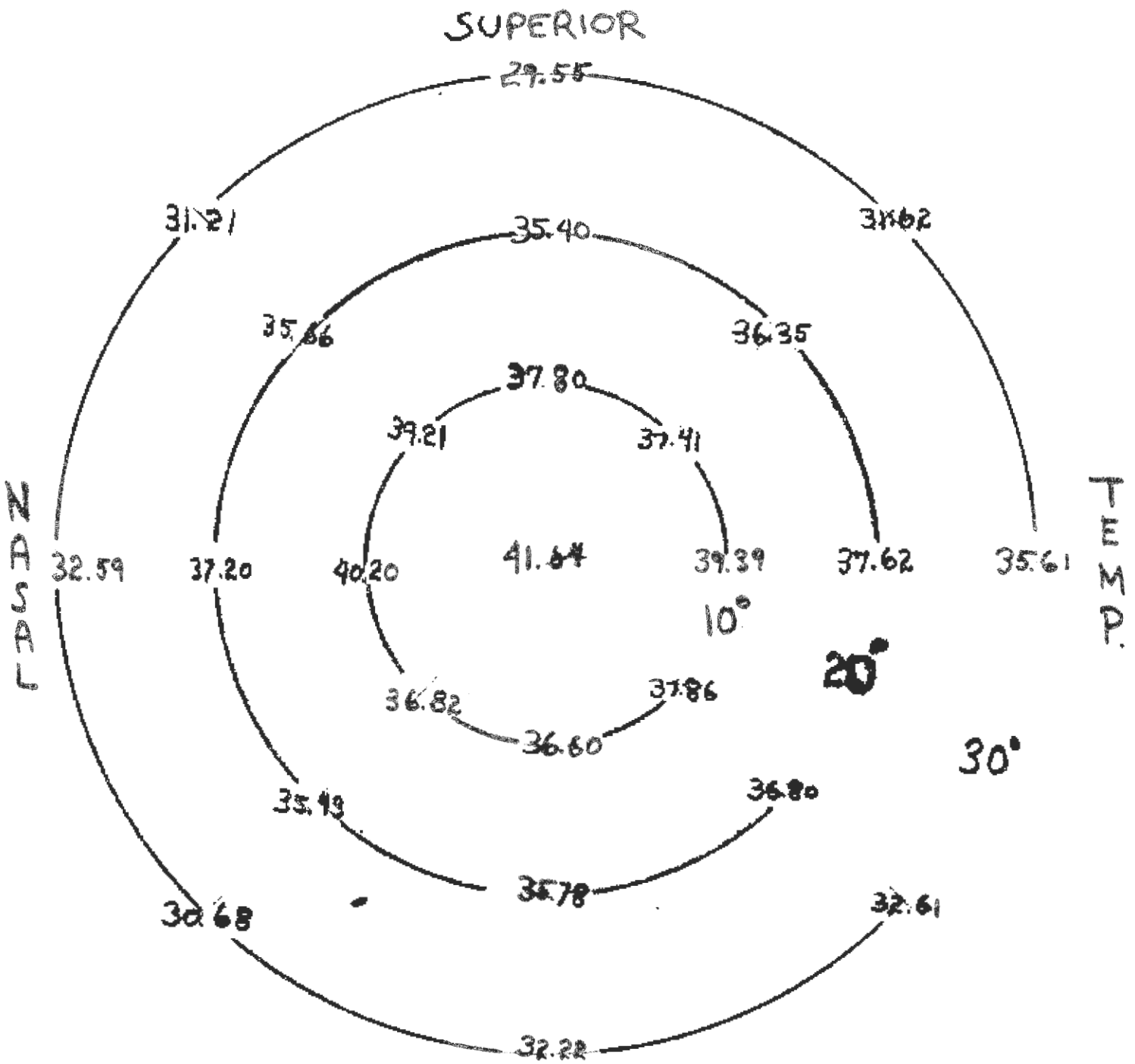
A BRIEF ACCOUNT OF DATA, METHODS, AND PROCEDURES

We recorded all of our data on the Bausch & Lomb one meter tangent screen record sheet. Our first step was to take a normal one meter tangent screen perimetric field. All scotomatous and abnormal (i.e. enlarged P.B.S.) areas were recorded as found. Our next step was to perform a C.F.F. field on the same patient. All readings were taken directly off the low scale of the stroboscope and later modified to cycles per second. The following mathematical formula was used:

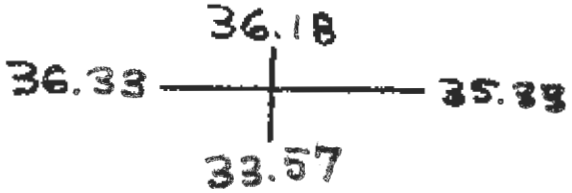
$$\frac{\text{Number from stroboscope} \times 100}{60}$$

These were recorded in the eight major meridians at 10, 20, and 30° intervals. Readings were taken along and immediately inside any plotted scotomatous areas. Readings were also taken at the superior, inferior, nasal, and temporal sides of the P.B.S.

The basis for determining increased or decreased function was the thesis study of Lindberg, Jamieson, Bowden, and Furie[6]. Diagram 1 shows the calculated C.F.F. means plotted on a field chart as found by the above thesis. Diagram 2(i.e. key sheet) shows the differences in each meridian at 10, 20, and 30° intervals as subtracted from the central fixation point C.F.F. reading. The criterion for a significant decrease in function is as follows: The subjects C.F.F. rates in the indicated areas were subtracted from his central C.F.F. rate and if this difference exceeded the differences indicated in the corresponding area shown by figure 2, page 8, it was considered to be significant. All significant decreases based on this criterion are identified by a square enclosure.

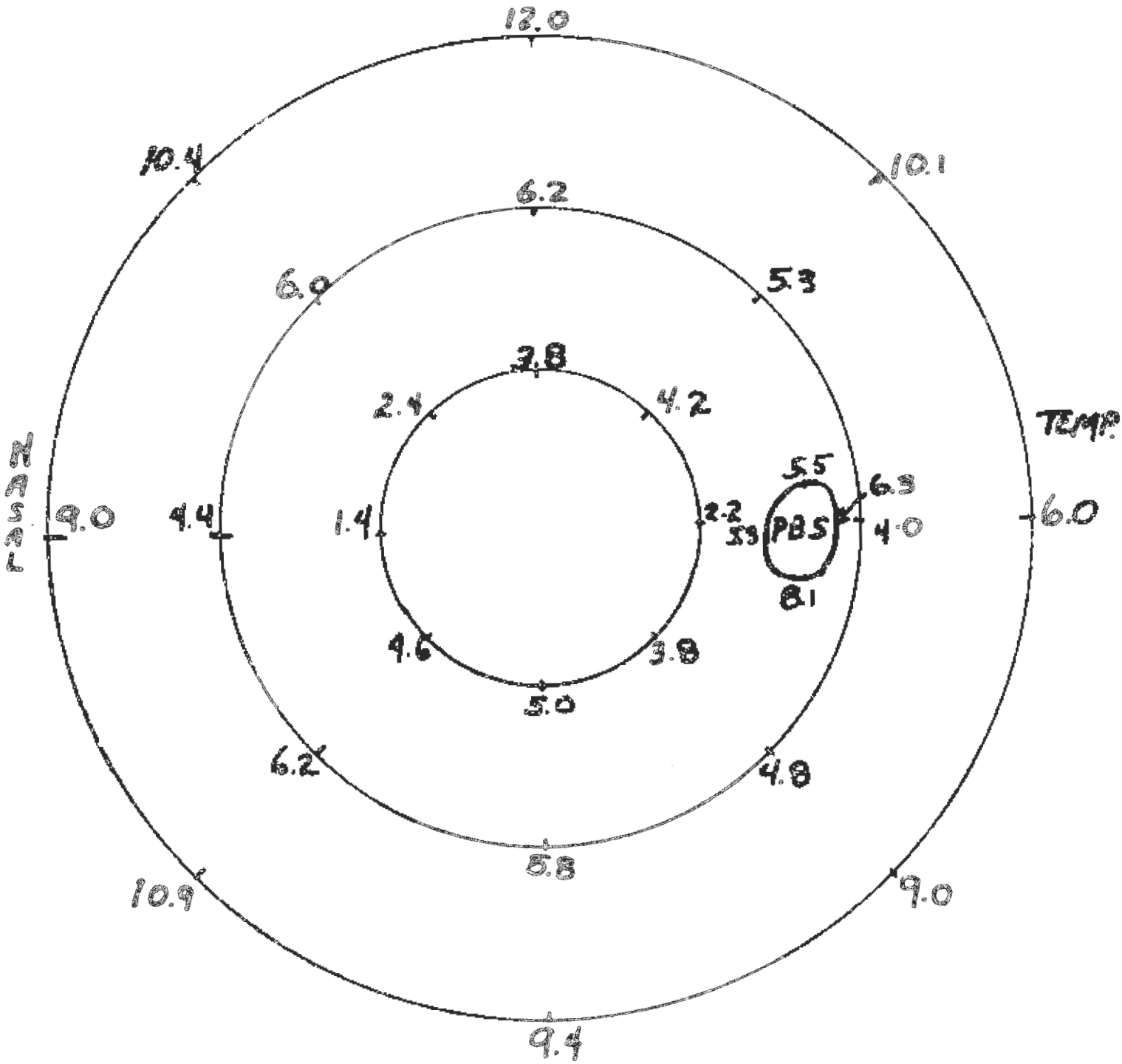


C. F. F. MEANS PLOTTED ON A FIELDS CHART



C.F.F. MEANS FOR LIMITS OF P.B.S.

DIAGRAM NO. 1



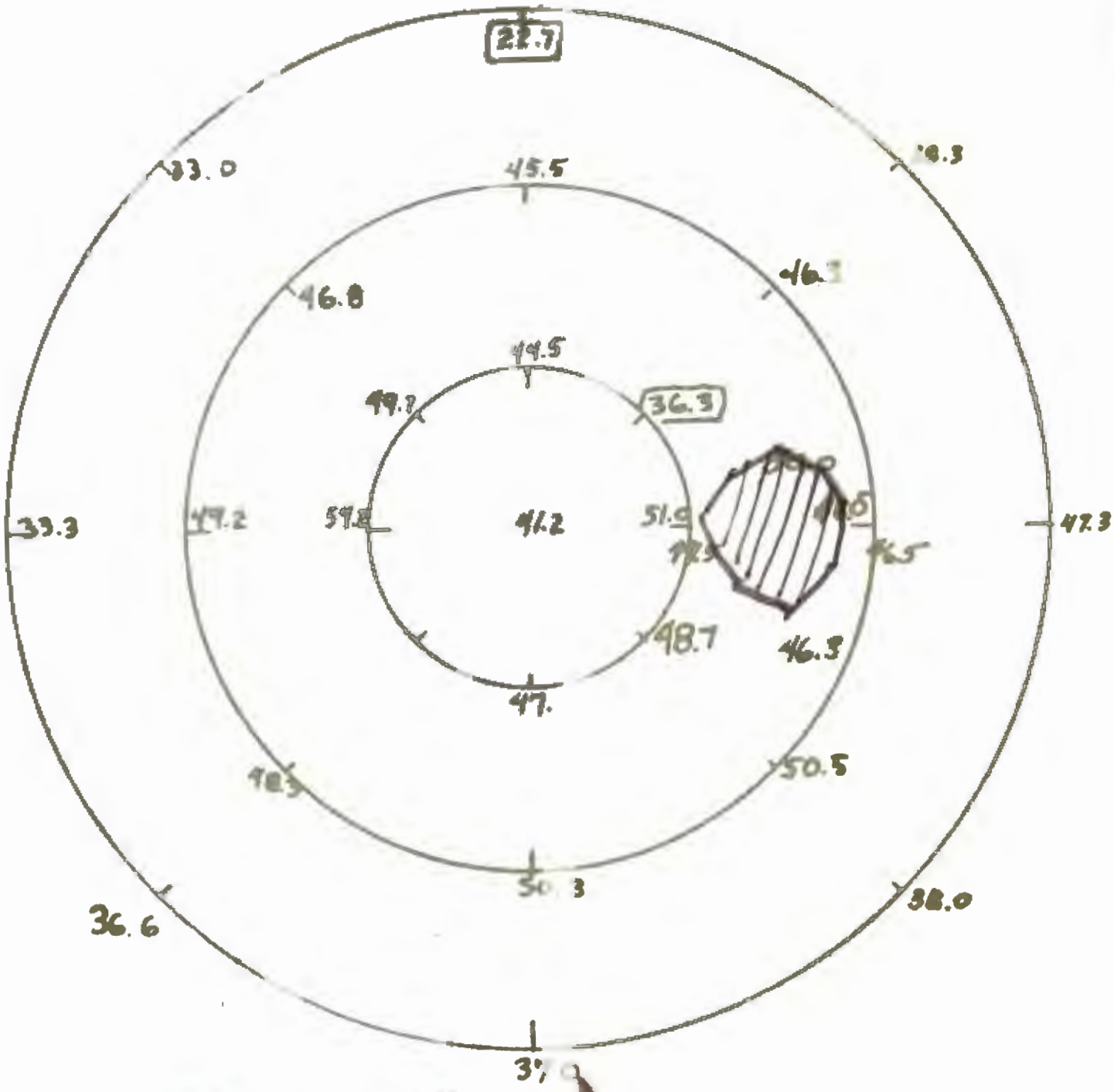
Key Sheet

DIAGRAM NO. 8

Note: This key sheet shows the gross average difference of each major meridian (at 10°, 20°, 30° intervals) as subtracted from the central fixation point average. These are taken directly from di-gram no. 1.

DATA AND INTERPRETATION OF FINDINGS

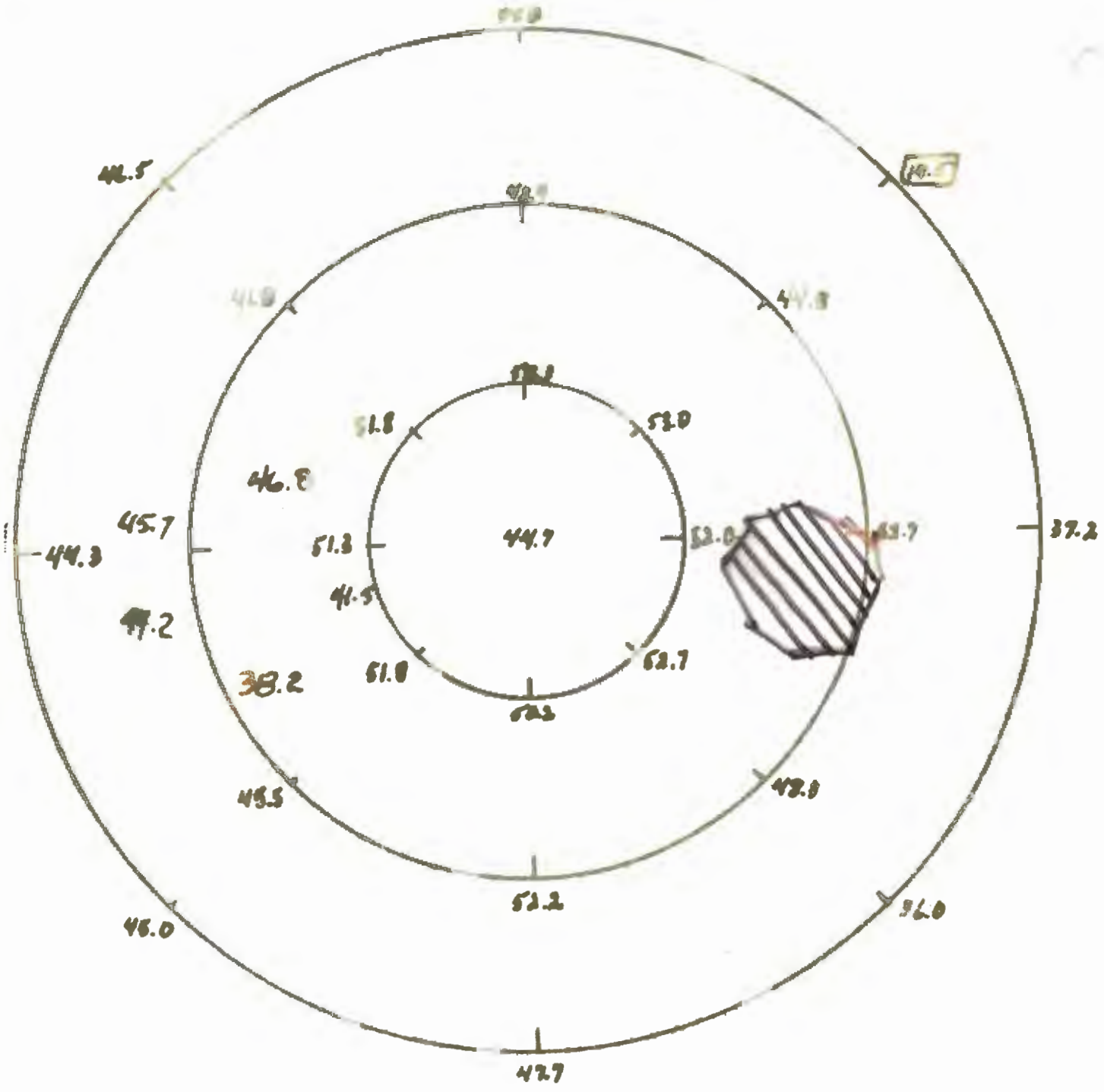
In this section each field of each eye of seven patients will be represented by a diagram and a plastic overlay. The diagram represents the C.F.F. field of the patients with significant decreased function being enclosed in squares. The plastic overlay represents areas of abnormality as derived from the one meter tangent field and plotted by conventional methods.



CASE / M.R. OD

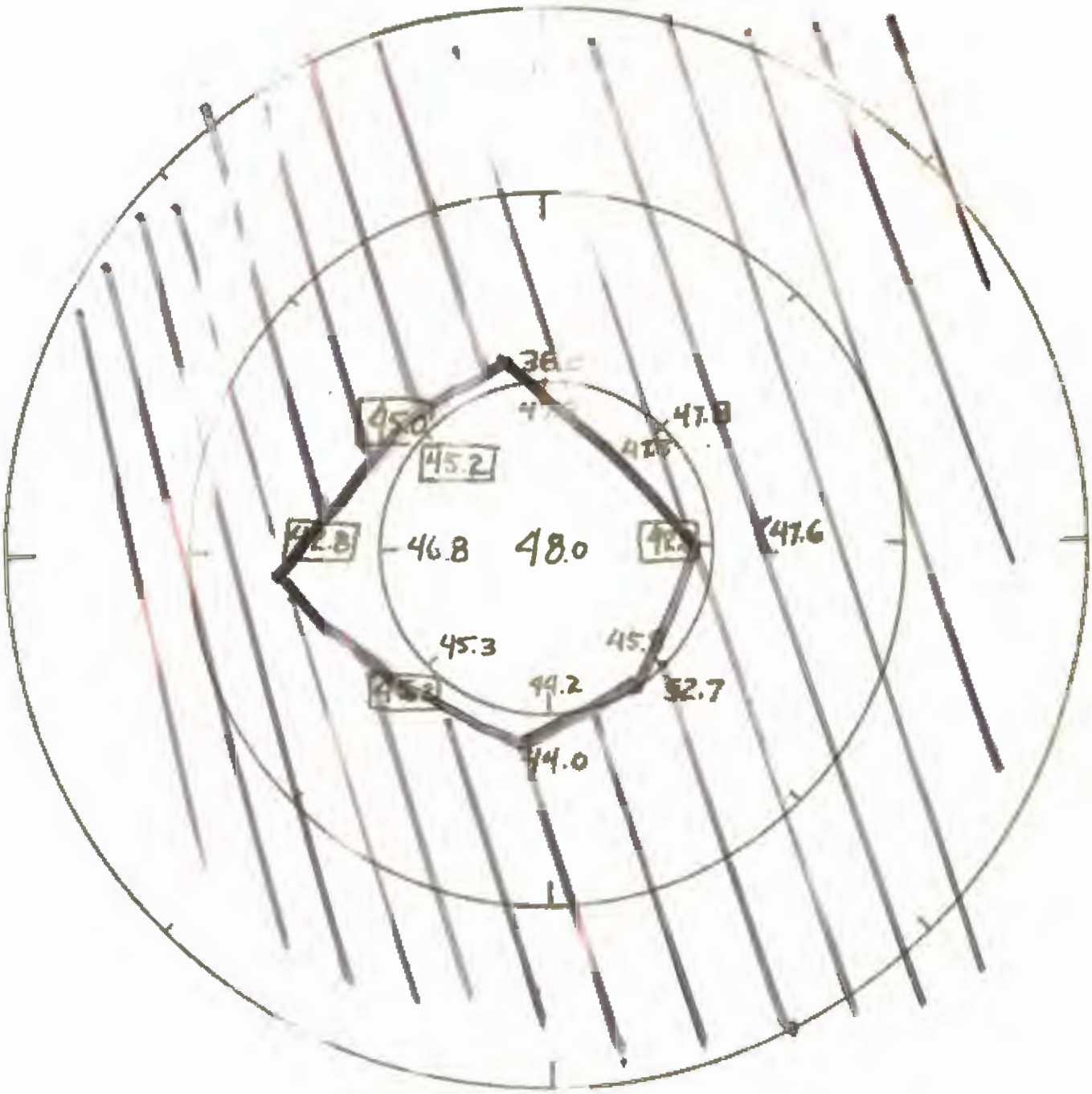
CASE / M.R. O.D.

REMARKS: Rainwater OD Time 4:00 P.M.
Negative.



Case / M.R 20 A.M 1 YEAR

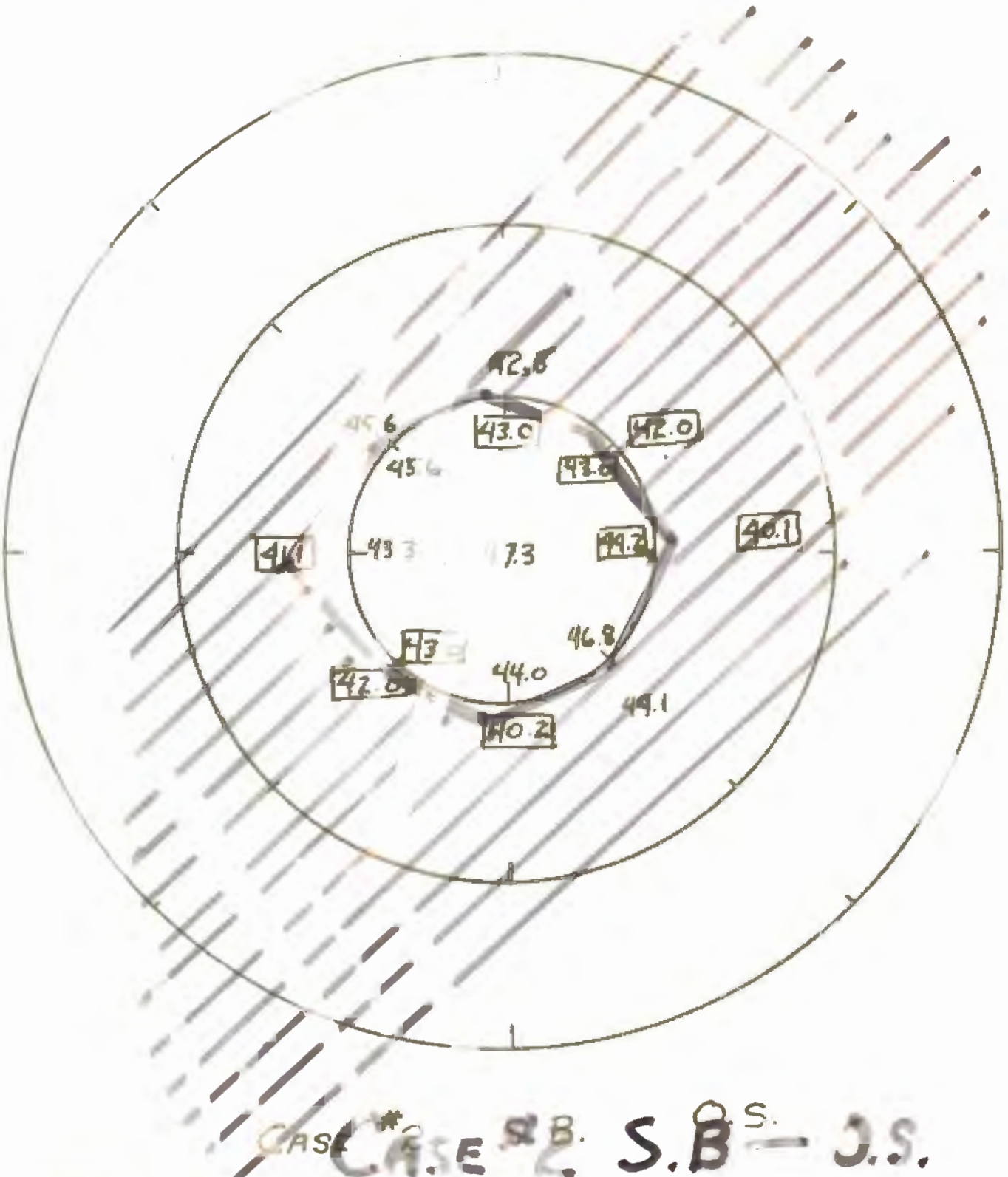
REMARKS: Kymmeter 08 Time 1:45 P.M.
Enlarged P.B.S. No evidence of decreased function.



Case # 2 S 3. O.D.

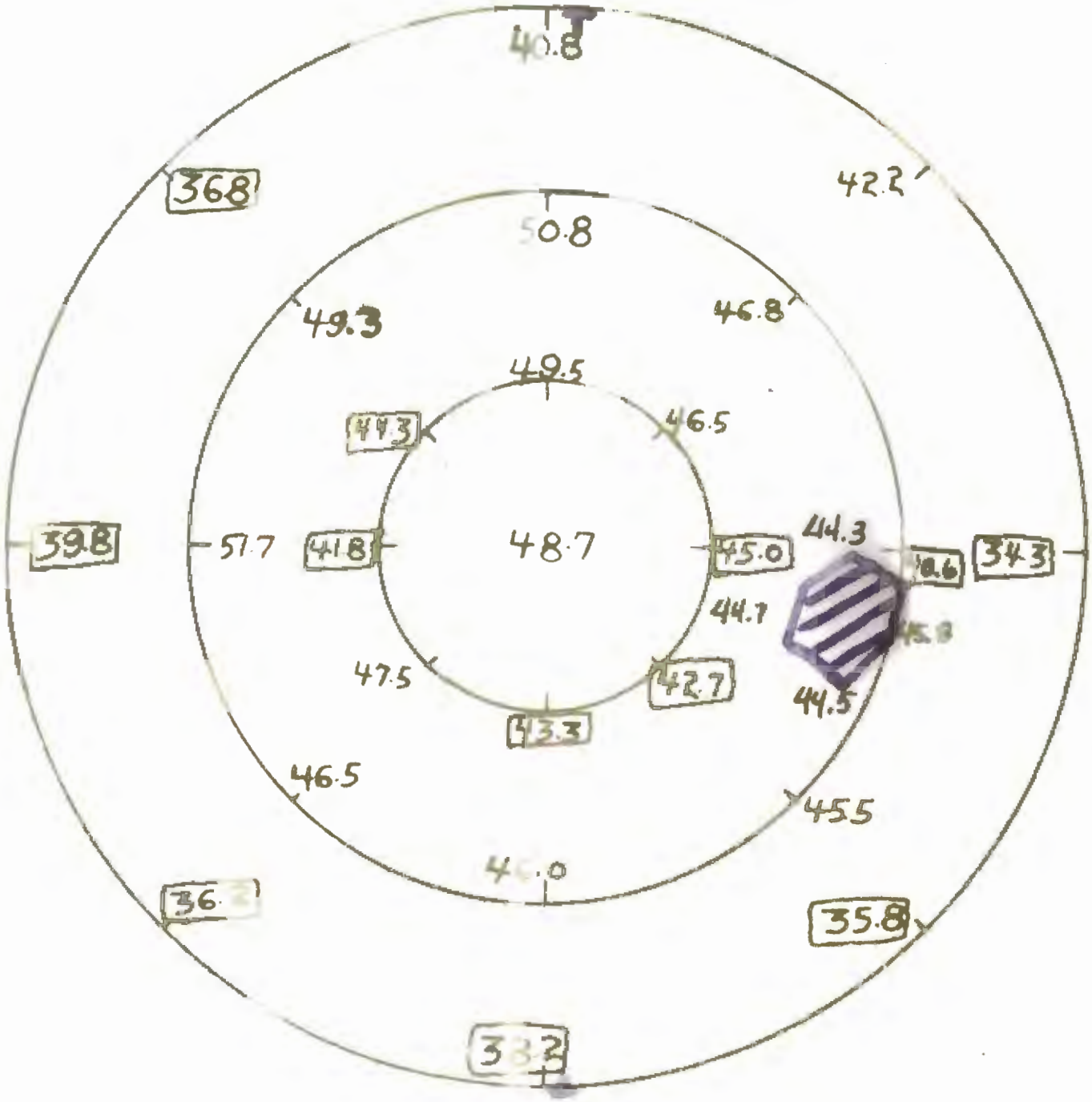
Case # 1 S.D. O.D

REMARKS: ... OD ... 2 ... Patient ... in for ... ation upon advice of school after routine testing (monocul... only). Patient was found to have highly constricted field... on one meter tangent screen testing method. She showed highl... decreased funct...ion of C.F.F. surrounding field.



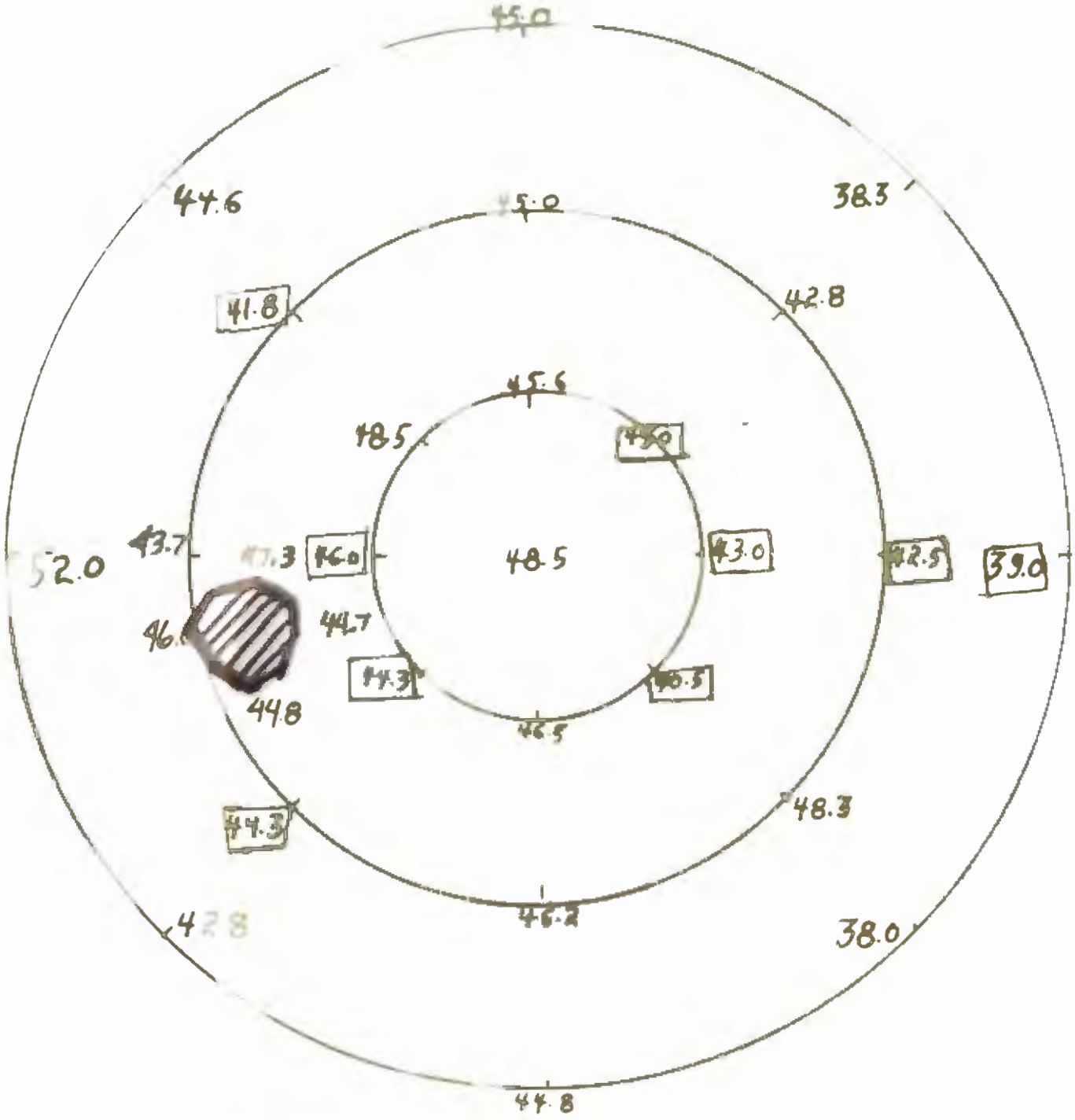
CASE #2 S.B. O.S. — O.S.

REMARKS: Busser OS Time 2:30 P.M.
Patient came in for examination upon advice of school after routine testing (monocular only). Patient was found to have highly constricted fields on one meter tangent screen testing method. She showed highly decreased function of C.F.P. surrounding field.



Case "3 T. T. OD

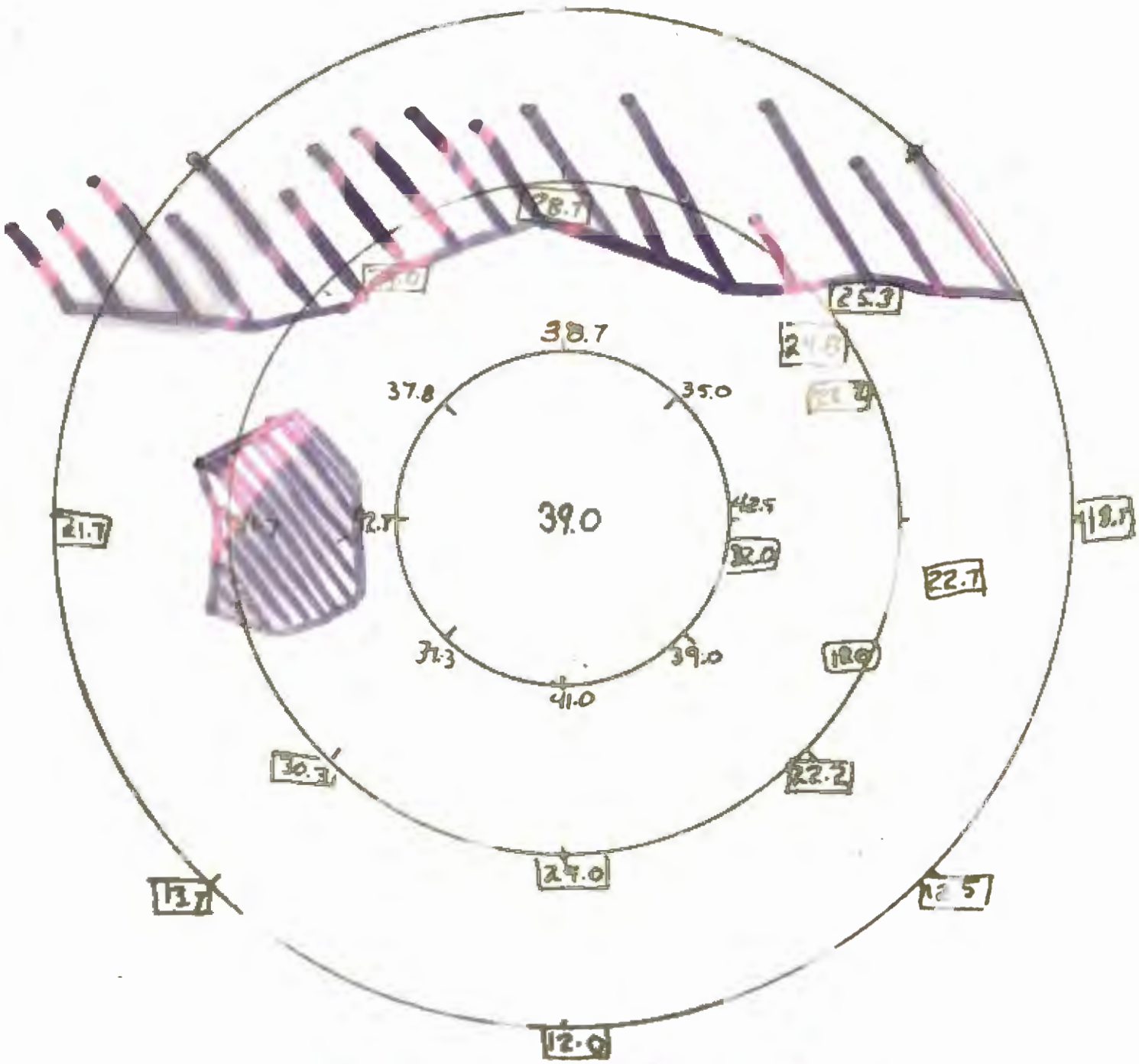
REMARKS: Trevillian OD Time 2:15 P.M.
Slightly inferiorly displaced ITA. There is decrease[d] funct[ion] at 10° field and some decrease in extinction in lower ha[lf] of 30° field.



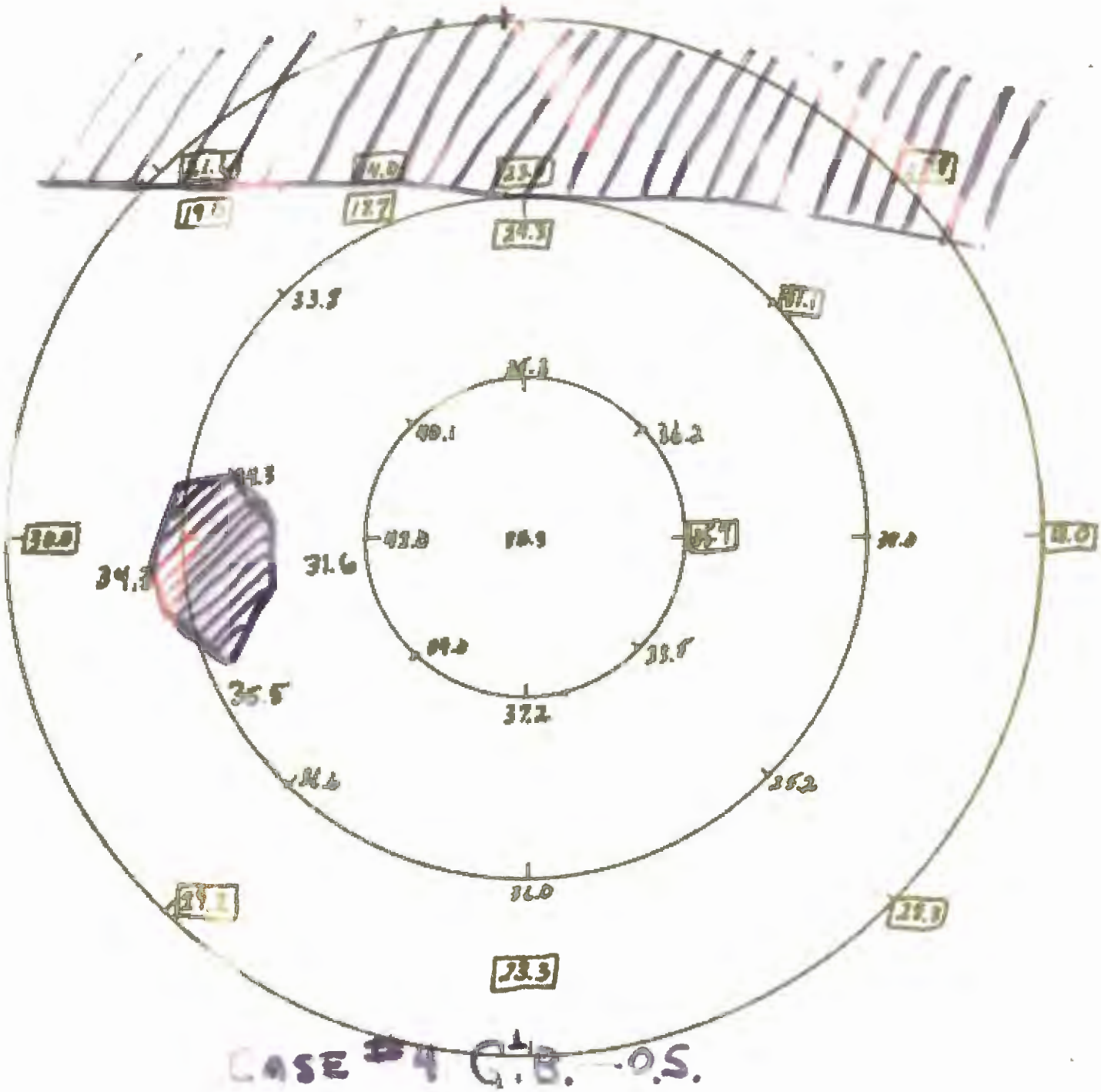
Case # 3 T T. OS

REMARKS: Tr[illegible] an [illegible] 30 P.M.
Sl[illegible] [illegible] d[illegible] PBS. Decrease in function
in [illegible] exce[illegible] in [illegible] upper temporal quadrant. One
to two small areas of increased function in 20° and 30° [illegible].

CASE #3 TT-OS

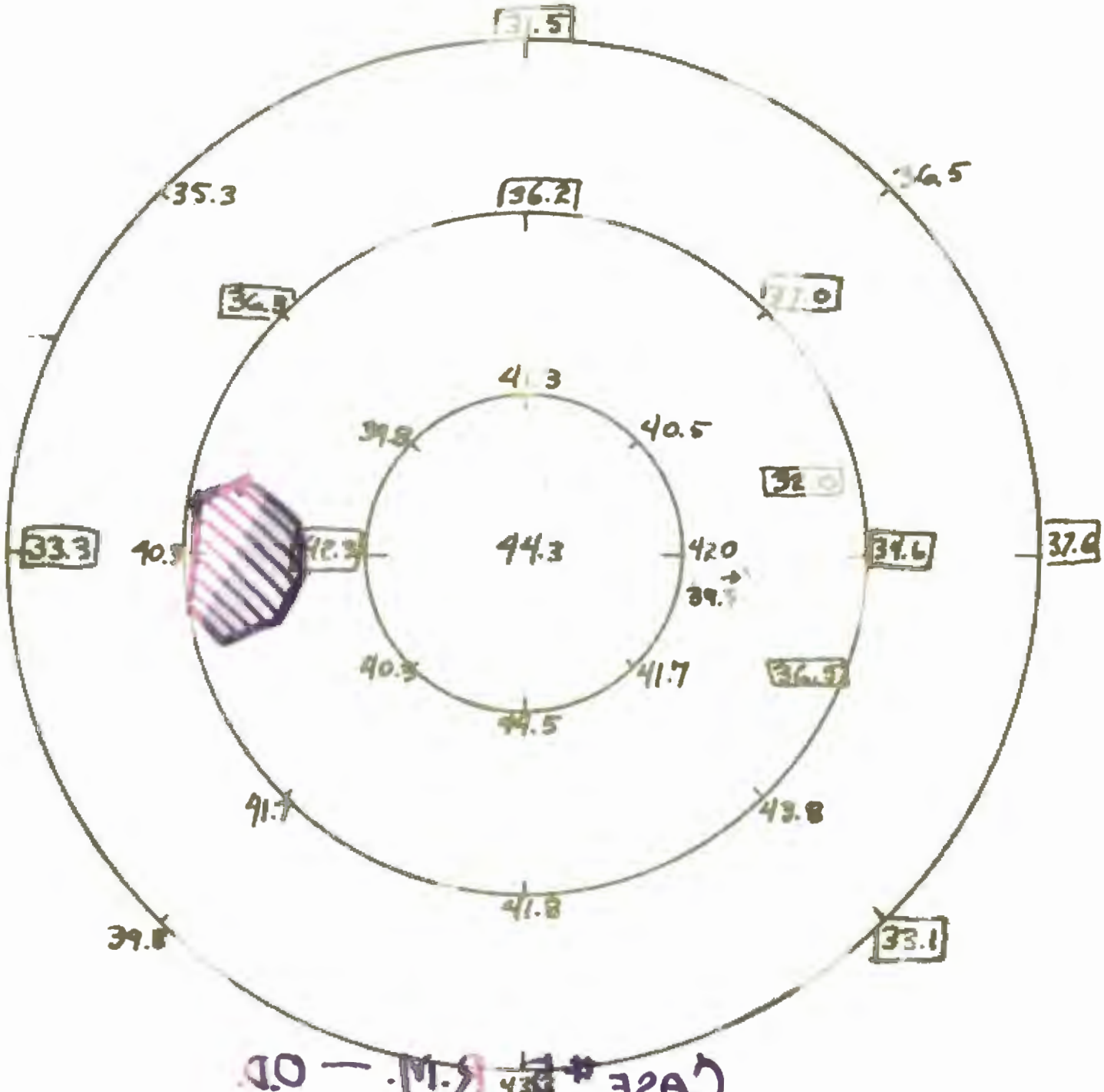


Burke OD [illegible] 3:15 P.M.
No Rx - Enlarged P.B.S. - Temporal sectored scotoma - Decreased function was found around P.B.S. & scotomatous area. However, decreased function was also found around the 30° & 30° fields.



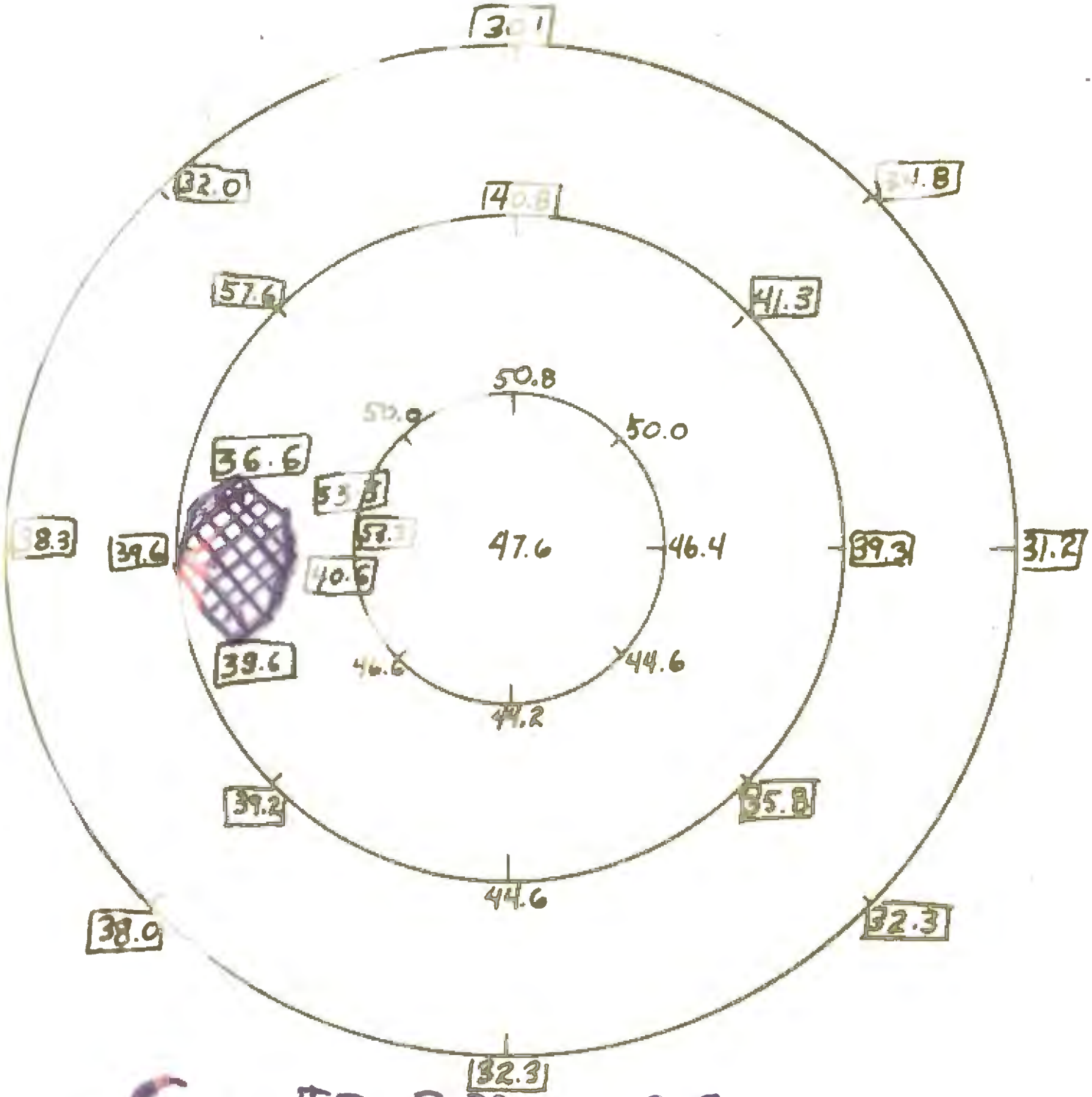
CASE 4 G.B. O.S.

REMARKS: Burke 28 Time 3:15 P.M.
No Rx - Enlarged P.B.S. - Blind area on top may be due to physiological factor as patient had a very heavy brow.



CASE #5 R.M. O.D

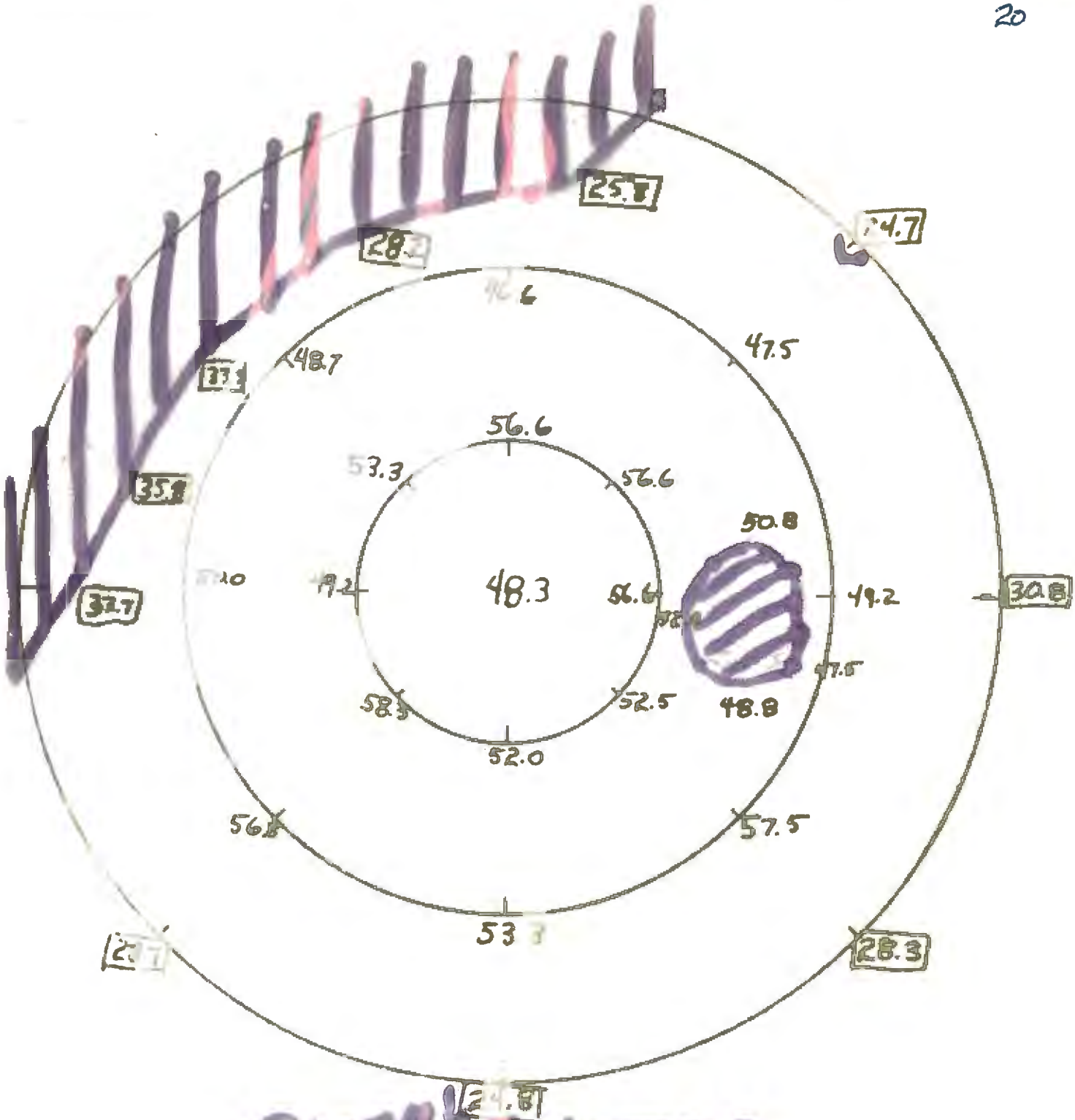
REMARKS: Martin OD Time 4:20 P.M.
Rx worn - Enlarged P.B.S. found in previous examination.
Patient showed decreased fumotion around P.B.S. and 20° & 30° fields.



Case #5 R.M. — O.S.

CASE #5 R.M. O.S.

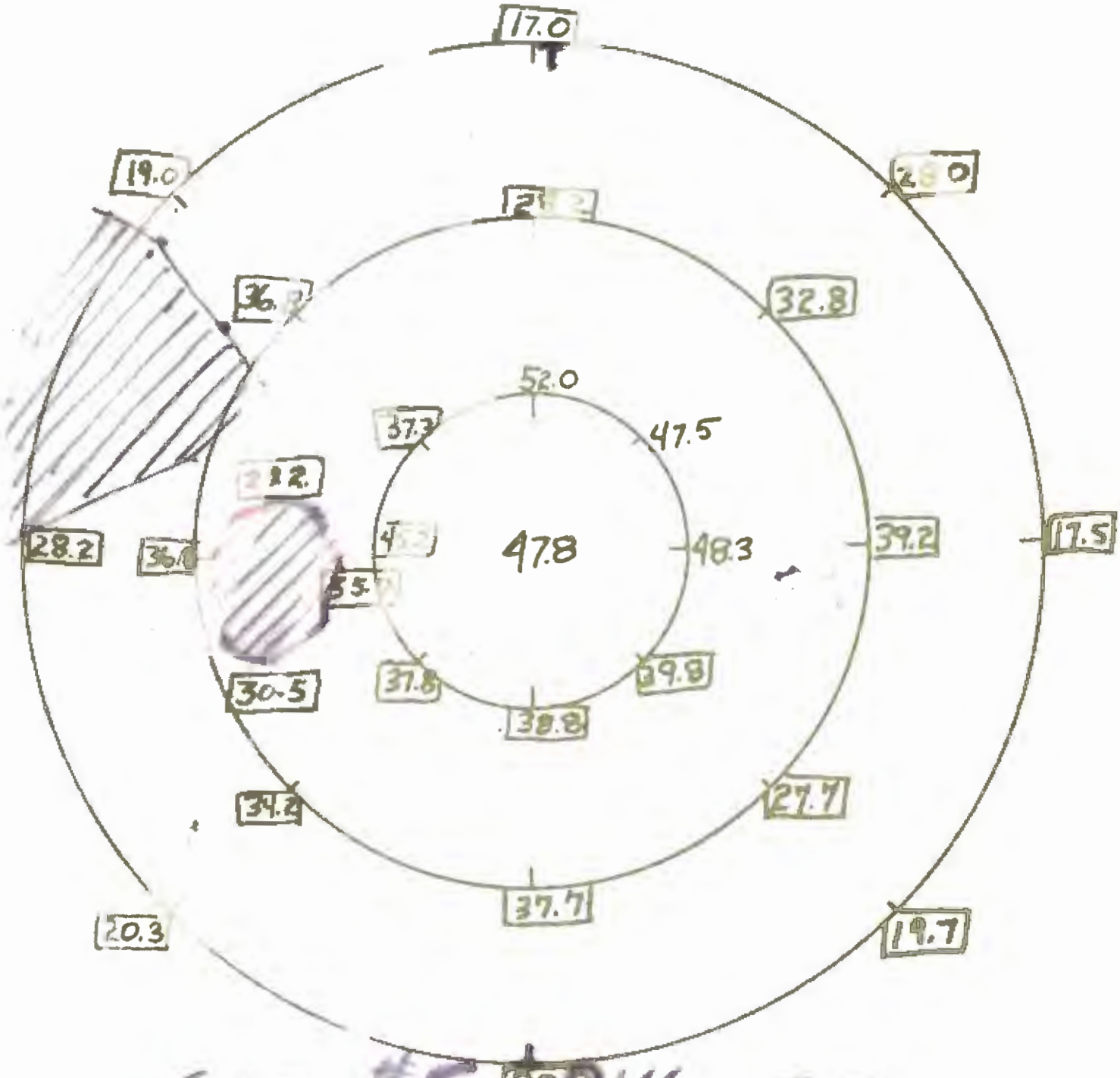
REMARKS: Martin DS Time 4:15 P.M.
Rx worn - Enlarged P.B.S. - FFF around P.B.S. shows decrease function in three meridians. Also decrease function recorded in various meridians of the field.



CASE #6 P.W. O.D.

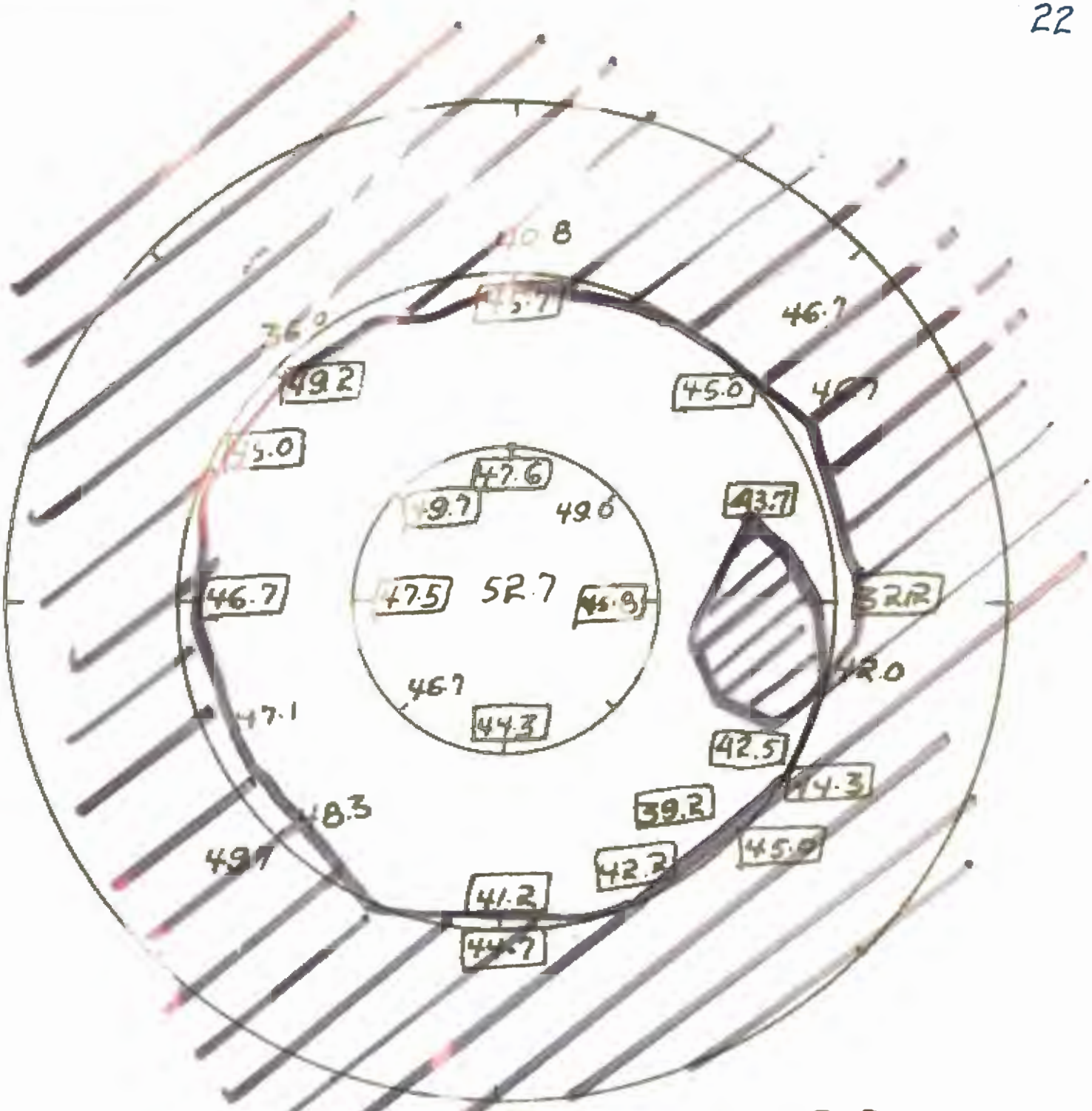
CASE #6 P.W. O.D.

REMARKS: Williams OD Time 3:00 P.M.
No Rx worn - P.B.S. appears normal in size. A noticable decrease in function was evident along the scotomotons area in upper temporal quadrant just outside the 20° area, and also around the 30° area.



CASE #6 P.W. O.S.

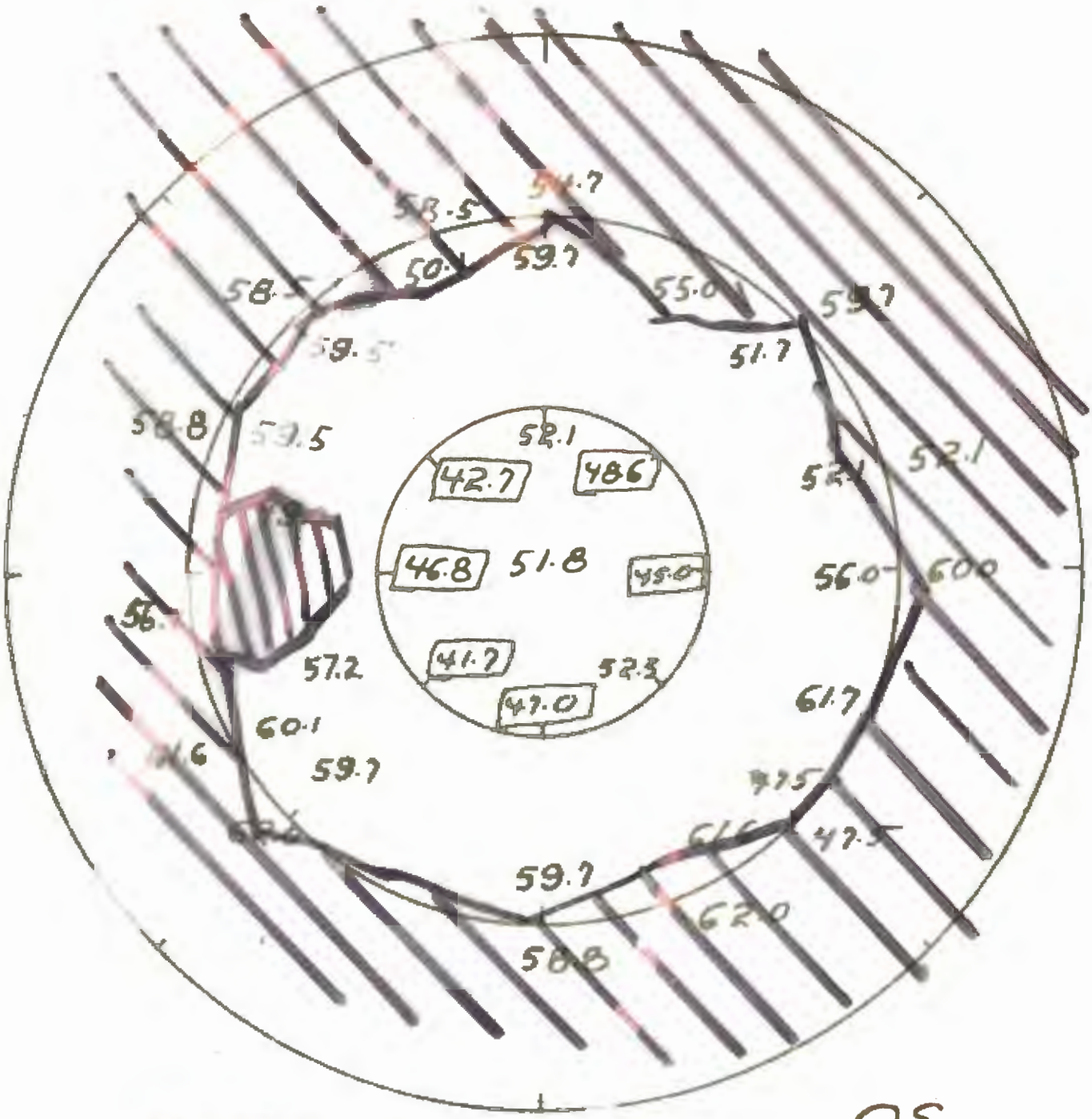
REMARKS: Williams OS Time 3:00 P.M.
Slightly enlarged P.B.S. A marked decrease in function is displayed in 10°, 20°, and 30° areas. The only area showing no decrease in function is the upper nasal quadrant of the 10° area A wedge shaped scotoma is also present in the upper temporal quadrant in the 30° area.



Case #7 S.J. OD

REMARKS: O.D. Time 2:15 P.M.
Concentric contraction of the peripheral field. Decreased function recorded in central field.

Case # 7 S.J. — O.D



OS.

CASE T. J. OS

REMARKS Jensen OS Time 2:00 P.M.
Concentric contraction of the peripheral field. Decreased function recorded at the 10° level.

CONCLUSIONS & DISCUSSION.

We found that in five of the seven cases the statement by Miles that there is an increase in function in the inferior nasal field was true. We also found that where there was a definite scotomatous or hemianoptic area there was a decrease in function along the dividing line. These findings it will be noted straddled the dividing line. This is demonstrated in case number 2, S.B., number 4, G.B., number 6, P.W., and number 7, S.J. According to Harrington[9] there is a permissible difference of about five flashes per second between the two eyes in the foveal area but the periphery of the two fields should be almost identical. Comparative studies of the flicker rate on the two eyes are particularly useful in diseases which may be unilateral, such as glaucoma which is demonstrated in case number 3, T.T., number 5, R.M., number 6, P.W., and number 7, S.J.

Miles[1] states that in the periphery beyond 20° if there is a uniformly low drop it may be due to age changes or small pupils. The only possible example we found of this was in case number 4, G.B.

In those patients that displayed a scotomatous area the most we could bring our wand into this area was about three cm. (2°). Patients were asked to report the C.F.F. when at least one half of the circular disk was visible.

We find it difficult to make a conclusion that a decrease in function will always accompany a field that demonstrates lowered function by standard methods. We found that even in eyes that showed only an enlarged blind spot on the one meter tangent screen there was an occasional decrease in function in the whole field

as measured by the C.F.F. method. It may also be concluded that an enlarged P.B.S. does not necessarily mean a decrease in function in C.F.F. field.

On the basis of our findings we feel there is a high degree of correlation between the C.F.F. fields and the one meter tangent screen method, especially where a definite field defect was found.

RECOMMENDATIONS.

It was found again as in the study by Lindberg, Jameison, Bowden, and Furie[6] that some of the subjects said that they were influenced or able to hear the sound of the flicker sooner then it was visually perceived.

We also feel that we cannot make a diagnosis of glaucoma because we do not have a medical diagnosis available to us. We also feel that even with practice a good C.F.F. field seems to require the same care and length of time as the examination with standard methods of perimetry.

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