CLINICAL COMPARISON BETWEEN SUPRATHRESHOLD AND THRESHOLD AMSLER GRID TESTING

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ABSTRACT

The Amsler Grid as commonly used in the clinical situation is a suprathreshold central visual field test. This test can be made more sensitive by crossing two polaroids at an angle in which the white lines on the grid are barely visible. Crossing the two polaroids can reduce the contrast to a threshold level thus allowing more subtle defects to be detected. Fifteen patients with various maculopathies were tested using both the suprathreshold and threshold Amsler Grid techniques.

INTRODUCTION

The Amsler Grid test as generally used for clinical testing is a suprathreshold test which evaluates 10 degrees of the visual field on either side of central fixation. The Amsler Grid itself measures $10cm^2$ on a black background with white lines at 5mm intervals that run both parallel and perpendicular to each other. When the grid is held at the recommended distance from the eye (28-30cm), each square subtends an angle of 1 degree.[1-2] This test is used to detect macular defects which exhibit themselves as changes in the grid pattern. Patients with defects detectable by this method will qualitatively state the white lines appear to be broken or wavy (metamorphosia) or areas will be missing (relative scotomas) on the grid. Crossing two polaroids and in turn reducing the contrast to a level where the grid lines are first visible will convert the standard Amsler Grid to a threshold test. Subtle changes in the standard Amsler Grid test will therefore become more evident and present themselves as more distinct changes at the threshold level.

The following illustrations put into perspective how the Amsler Grid projects anatomically on the retina as well as its relative size in comparison to the entire visual field.

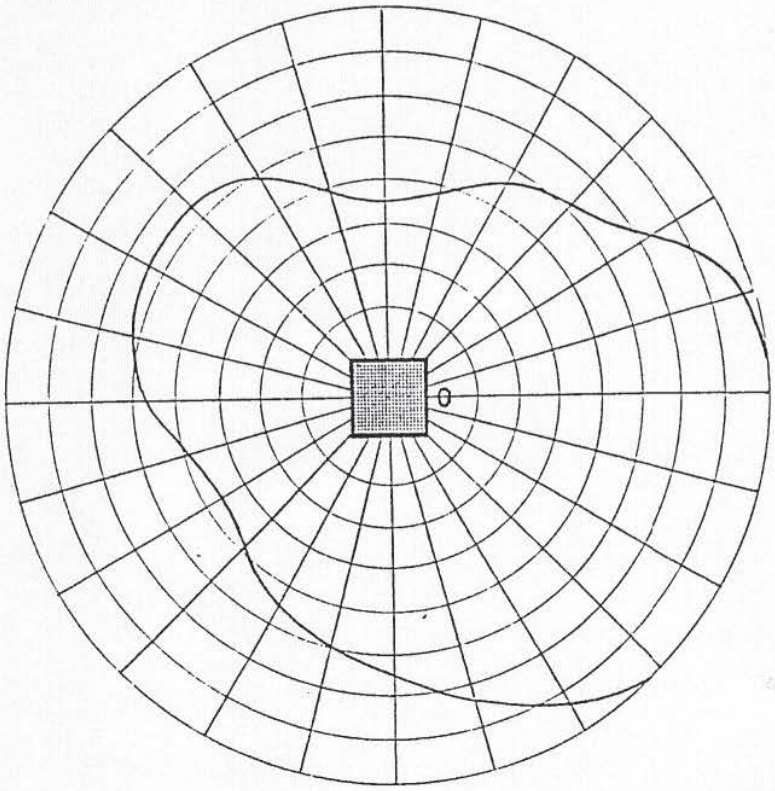


Fig 1. left, The grid within the visual field.

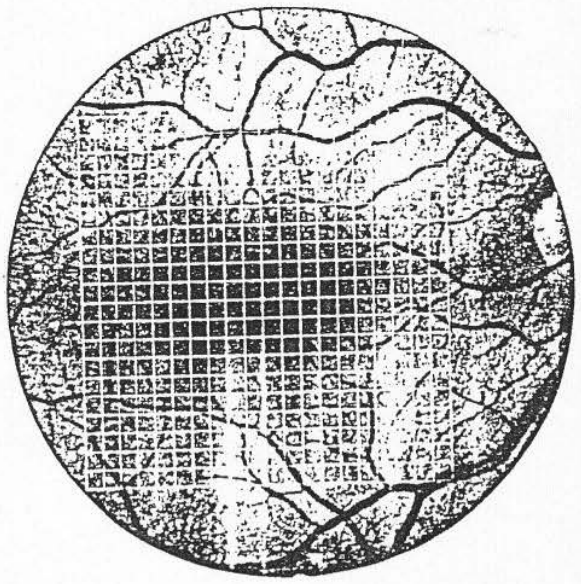
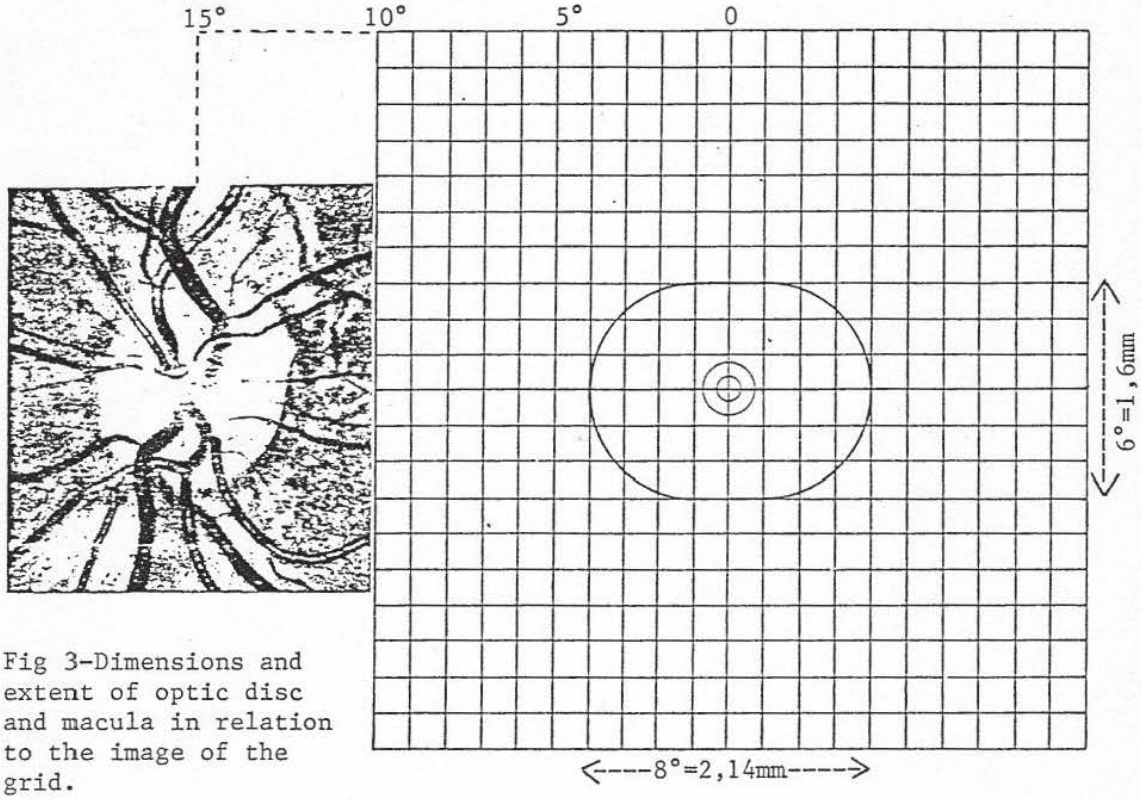


Fig 2. right, Image of grid projected on to the fundus.

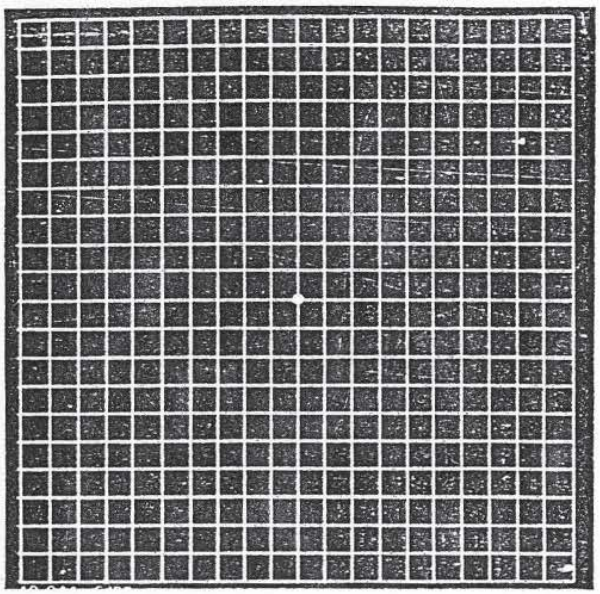


METHOD

The research involved fifteen veterans administration out-patients, with an age range of 59 to 75 years. All patients were male. The best corrected visual acuities ranged ranged from 20/20 to 20/400. Both eyes of each patient were best corrected with trial lenses in a trial frame at the test distance of 28 to 30cm. The suprathreshold Amsler Grid was tested first followed by the threshold Amsler Grid. The right eye was tested first while the left eye was occluded and vice versa. A goose neck lamp was used to maintain a constant uniform light source on the tested grids.

The patient was instructed to look at the center white dot throughout the entire test. The patient was asked if while looking at the center dot could all four corners be seen, if any of the white lines were broken or missing and if any of the lines appeared to be wavy or distorted like looking through a wet windshield? The patient was also asked if the center dot appeared to be blinking on and off to determine the quality of central fixation. The patient was then asked to point to the areas with defects and describe what they saw.

In performing threshold Amsler Grid testing two polaroids were crossed so that the angle of polarization was 90 degrees. While one polaroid remained fixed in the trial frame, the other was slowly rotated until the patient was first able to see the center white dot. The angle of polarization was slowly decreased until all patients responded to first visualizing the grid pattern. This angle of polarization was between 82°-86°.[3-4] Patients were then asked to point to the areas with defects and describe what they saw.



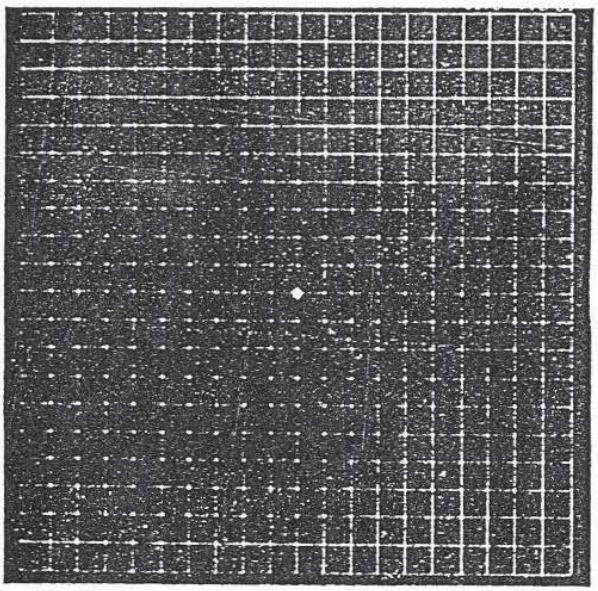


Fig 4 left, Standard white grid developed by Amsler(top), simulation of Amsler grid used with threshold testing method(bottom).

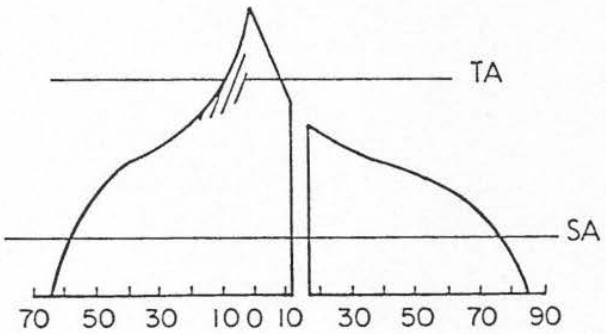


Fig 5 above, Sagittal section of visual island as would be plotted by static perimetry. Abscissa is degrees from central fixation. Ordinate is visual sensitivity. Relative scotoma (diagonal lines) is detected by threshold Amsler grid testing (TA). Standard Amsler grid (SA) stimulus surveys the island at too great a depth to detect the scotoma.

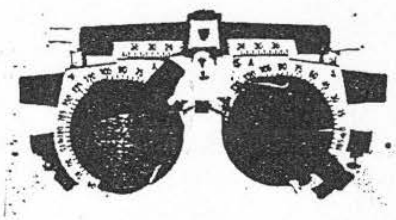


Fig 6 right, Polarized filters have been affixed to four blank trial lenses and placed in standard trial frames.

RESULTS

There were a total of thirty eyes tested. Of the thirty eyes, four had no evidence of macular defects while twenty-six had ophthalmoscopically evident maculopathies. There were six different types of maculopathies amoung the fifteen patients. Nine patients had age related macular changes, one had a macular hole, one had a central serous detachment, one had Best's disease, two had background diabetic retinopathy and one had a macular scar. One patient had Pseudotumor Cerebri.

Fifteen eyes had positive suprathreshold responses, while eight had a positive threshold response. Only eight eyes that had positive suprathreshold responses also had positive threshold responses. However, the positive threshold responses were not markedly different. There were no patients that had positive threshold responses while having negative suprathreshold responses.

RESULTS

Table 1. Results of central visual field testing on fifteen patients

Patient Number	Age	Race	Sex	Eye	V/A	Diagnosis	STAG	TAG	Meds
1	75	W	M	OD	20/400	ARM O.U.	+	+	
				OS	20/200		+	+	
2	70	W	M	OD	20/60	ARM O.U.	+	+	Timoptic
				OS	20/50	Glaucoma O.U.	+	+	Propine
3	68	W	M	OD	20/20	Unremarkable	-	-	
				OS	20/200	Macular Hole	+	+	
4	64	W	M	OD	20/100	Central Serous Detachment	+	+	
				OS	20/30	Macular Drusen	+	-	
5	65	W	M	OD	20/25	Macular Drusen O.U.	-	-	
				OS	20/25	Pavingstone Degeneration O.U.	-	-	
6	59	B	M	OD	20/100	Best's Desease O.U.	+	-	
				OS	20/200		+	-	
7	63	W	M	OD	20/30	Pseudotumor	+	-	
				OS	20/40	Cerebri	+	-	
8	72	B	M	OD	20/40	BDR O.U.	-	-	Pilocarpine
				OS	20/40	Glaucoma O.U.	-	-	Timoptic
9	70	W	M	OD	20/50	Macular Drusen O.U.	-	-	
				OS	20/25	Pigment Mottling	-	-	
10	61	B	M	OD	20/80	ARM O.U.	+	+	
				OS	20/40		+	-	
11	64	W	M	OD	20/25	Macular Drusen O.U.	-	-	
				OS	20/30	Pigment Mottling	-	-	

Table 1. Continued

Patient Number	Age	Race	Sex	Eye	V/A	Diagnosis	STAG	TAG
12	64	W	M	OD	20/20	Macular Drusen O.U.	-	-
				OS	20/25		-	-
13	66	W	M	OD	20/50	BDR O.U.	+	-
				OS	20/30		-	-
14	69	W	M	OD	20/25	Unremarkable	-	-
				OS	20/100	Macular Scar	+	+
15	72	W	M	OD	20/30	Macular Drusen O.U.	-	-
				OS	20/30		-	-

STAG = (Suprathreshold Amsler Grid)
TAG = (Threshold Amsler Grid)

DISCUSSION

Although it has been shown in the literature that the threshold Amsler Grid test is more sensitive in picking up subtle pathological conditions in the macular area, this author did not reach the same conclusion. Of the fifteen patients tested there were no patients who had positive threshold Amsler Grid responses after having normal suprathreshold responses.

Theorectically, by decreasing the contrast of the standard Amsler Grid test by two crossed polaroids to a threshold level, small depressions and metamorphopsia findings would become more evident by presenting as relative scotomas and thus allowing earlier detection of subtle macular defects. The results in this study would indicate that routine threshold Amsler Grid testing is not a practical clinical screening proceedure. To further illustrate this point, it should be noted that even patients with positive suprathreshold responses did not demonstrate an increased response with threshold testing.

The results obtained in this study do not coincide with the results available in current literature. However, it is this author's opinion there has not been enough research done and literature published to truely validate the threshold amsler grid technique. In all fairness to both sides of the debate, one must take into consideration the sources of error in this study. The population used in this study was relatively small. This author also feels that patient understanding of test instructions was in question. In contrast to patients tested in the published

literature, patients used in this study were for the most part not correctable to 20/20. This author believes that the difference in acuity criterion for testing is the most significant contribution to the contrary conclusion between this study and other available threshold Amsler Grid research.

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