Sensitivity And Specificity of Nassar Colour Test in Early Detection of Diabetic Macular Oedema

Moustafa Kamal NASSAR[1], Mohamed Yasser SAYED SAİF[2], Ahmed Tamer SAYED SAİF[3], Passant SAYED SAİF[4]

ABSTRACT

Purpose: This study aims to evaluate the Sensitivity and Specificity of Nassar colour discrimination test with the presence of macular oedema in patients with diabetes Mellitus as a sensitive diagnostic tool for the detection of early functional changes.

Materials and Methods: A Prospective, comparative case control study. The study included 120 eyes w with type I diabetes recruited from the outpatient clinic. All patients examined ophthalmologicaly and tested with Nassar Colour plate test, FFA and OCT. The Main Outcome Measures is The presence of mild or moderate tritans indicate early DME changes were documented in each group. Student's t-test and ANOVA (f) test were used for statistical analysis. P values less than 0.05 were considered statistically significant.

Results: The 120 patients seen were with type I diabetes. The mean age of the patients was 41.15±5.61 years (range 23-49 years) with a mean disease duration of 13.56±2.59 years (range 10-20 years). All patient with dry macula (n=60.50%) were normal while with DME showed normal (n=6.5%) , mild tritan (n=14, 11.66%) and moderate (n=40, 33.33%) the nassar color test is 90% Sensitive and 100% Specific

Conclusions: The Nassar color plate is a cheap and effective test to early detect macular edema and recommend to be used in all ophthalmic primary examination especially in areas far away from OCT and FFA

Key Words: Colour test, diabetic macular oedema, nassar colour plates, tritans anomaly.

INTRODUCTION

Color blindness or color vision deficiency is the decreased ability to perceive differences between some of the colors that others can distinguish, it may be inherited or acquired and can be diagnosed by color vision tests like ishihara, franthworth D D-15 test, Nassar color plates. Anatomical study has demonstrated that the centre of the fovea appears to be devoid of S-cones in primates.[1-2] The extent of the foveal tritanopic region is around 20-25 minutes of arc.[3]

Despite effective treatments, diabetic retinopathy is still the most common cause of blindness in industrialized nations among the 20-60 year old age group.[4]

The detection of presymptomatic sight threatening diabetic retinopathy (STDR) remains difficult. Early treatment of proliferative diabetic retinopathy and diabetic maculopathy improves visual outcome. However, STDR should be detected before visual damage has taken place as only a minority of patients have improvement in vision following laser treatment. With effective screening blind registrations for patients under the age of 70 could be reduced by 10%. Screening is clinically viable and cost effective and will be increasingly important as the incidence of diabetes rises over the next 10 years.[5]

1- M.D. Professor, Menoufiya University Faculty of Medicine, Department of Ophthalmology, Menofia/EGYPT NASSAR M.K., mostafan@hotmail.com
2- M.D. Asistant Professor, Beni Suef University Faculty of Medicine, Department of Ophthalmology, Beni Suef-Cairo/EGYPT SAYED SAIF M.Y., ysaif@sayedsaif.com
3- M.D. Fayoum University Faculty of Medicine, Department of Ophthalmology, Fayoum/EGYPT SAYED SAIF A.T., ahmedtssaif@yahoo.com
4- M.D. Misr University Faculty of Medicine, Department of Ophthalmology, EGYPT SAYED SAIF P., passantsaif@gmail.com

Geliş Tarihi - Received: 09.04.2015
Kabul Tarihi - Accepted: 06.08.2015
Ret-Vit 2016;24:109-113

Yazışma Adresi / Correspondence Adress:
M.D. Asistant Professor, Mohamed Yasser Sayed Saif
Beni Suef University Faculty of Medicine,
Department of Ophthalmology, Babel Louk sq Cairo/EGYPT

Phone: +20 100 669 92 88
E-mail: ysaif@sayedsaif.com

AIM

This study aims to evaluate the Sensitivity and Specificity of Nassar colour discrimination test with the presence of macular oedema in patients with diabetes mellitus as a sensitive diagnostic tool for the detection of early functional changes

MATERIALS AND METHODS

The ethic committee approved the study protocol and an informed consent was signed by all the patients in the study

Design: Prospective, comparative case control study.

Participants: The study included 120 eyes with type I diabetes recruited from the outpatient clinic in Beni Suef University, Fayoum University and MUST University hospitals.

Inclusion Criteria

- Patients who have a type I diabetes
- Patients younger than 50 years of age

Exclusion Criteria

- History of previous eye disease known to affect color vision such as glaucoma, signs of significant media opacification as determined by slit lamp examination through a dilated pupil.
- Patients with lens opacities because of the influence of nuclear sclerosis on color vision.
- Patients with more than mild proliferative diabetic retinopathy.
- Patients who had a history of intraocular surgery or laser therapy, because patients can have a tritan defect as a side effect of laser therapy.
- Patients with Chorioretinal scars in the macula were also excluded.

Full history taking considering the age of the patient, type and duration of diabetes as well as mode of diabetes control. Family history of diabetes mellitus, history of known ocular diseases, and history of other medical diseases were recorded. Best corrected visual acuity (BCVA) was measured using the Snellen chart followed by Nassar Colour plate test followed by complete ophthalmological examination of anterior segment to detect any opacities or rubiosis iridis using slit lamp examination, tonometry using applanation tonometer, then pupillary dilatation with tropicamide 1%. Patients were then examined by a slit lamp biomicroscope with Goldman three mirror contact lens to detect Stage of diabetic retinopathy, macular edema, any other vascular retinal diseases,any degenerative retinal diseases or optic disc abnormalities such as glaucomatous cupping, NVD, haemorrhage, or papillodema.

Fundus Fluorescein Angiography and OCT were done to all patients. All patients were screened using Nassar color plates.

Nassar Color Plates

32 plates were designed to be tested in daylight or at least as close as possible to it. Plates contain Arabic numbers and letters, -algebric diagrams, figures and lines to be traced by figure (Figure 1&2) . The plates are held 75 cm from the subject and at a right angle to the line of vision. The answer should be given within 3 seconds and figures to be traced within 10 seconds. Plates 21-24 : test blue- yellow color sense.

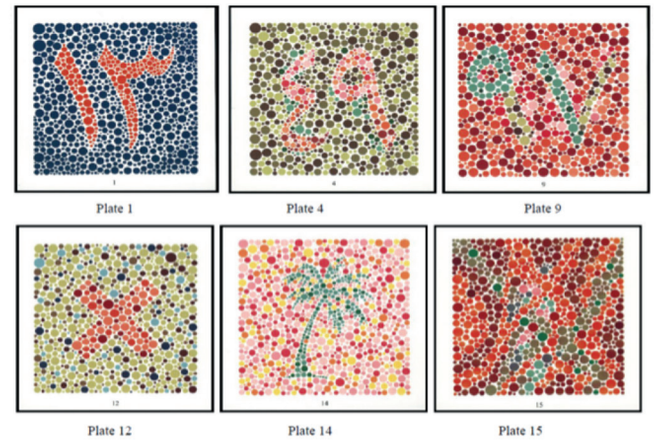

Figure 1: *Samples of nassar color testing plates.*

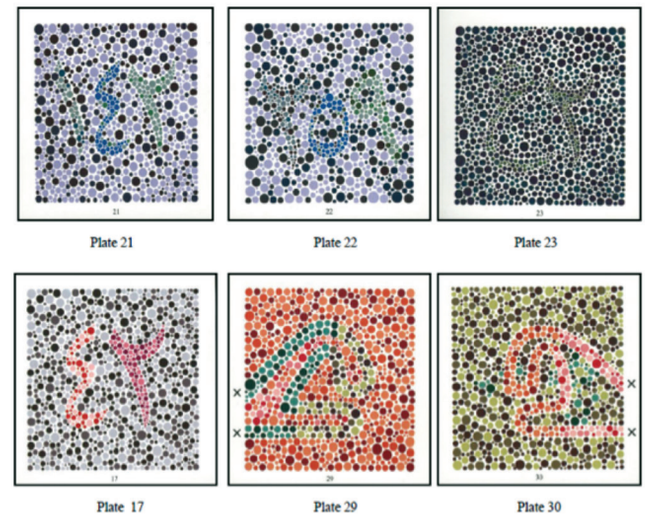

Figure 2: *Samples of nassar color testing plates.*

Classification of Diabetic Retinopathy

The stage of retinopathy was graded using the European grading protocol.[6] In which, eyes classified as having pre-proliferative retinopathy, proliferative retinopathy, or maculopathy were considered as having sight threatening diabetic retinopathy (STDR). While eyes having no retinopathy or background retinopathy were considered as having non-sight threatening diabetic retinopathy (NSTDR).

Main Outcome Measures: The presence of mild or moderate tritans indicate early DME changes were documented in each group. Student's t-test and ANOVA (f) test.

Were used for statistical analysis. P values less than 0.05 were considered statistically significant.

All patient data was collected in a Microsoft 2007 excel sheet and analyzed usin SPSS ver16 software.

RESULTS

This study included 120 patients recruited from the ophthalmology outpatient clinic in Beni Sueif University hospital, Fayoum University, and MUST University with type I diabetes. Patients will be classified into the following groups:- group 1 with diabetic macular edema and group 2 without diabetic macular edema. All patients were subjected to Fundus Fluorescein Angiography, OCT and Nassar color plates

The 120 patients seen were with type I diabetes. The mean age of the patients was 41.15±5.61 years (range 23-49 years) with a mean disease duration of 13.56±2.59 years (range 10-20 years). Table 1 summarizes the details of demographic data of the patients.

Table 1: *Demographic data of studied group.*

diagnosis	Sex	Average of Age	Average of duration of DM
DME	F	44.07	14.74
	M	42.54	13.93
DME Total		43.23	14.3
Dry macula	F	37.47	12.35
	M	41.15	12.15
Dry macula Total		39.06	12.83
Grand Total		41.15	13.56

This table shows that prevalence of mild tritan by NASSAR color plate is significantly higher among male patients while moderate tritans were significantly higher among females (P<0.05).

Mean age of normal patient by NASSAR plate is significantly lower than mild & moderate tritan (P<0.05).

Table 2: *Number&percentage distribution of BCVA among studied group.*

diagnosis	VA	LogMAR	Total
DME	6/12	0.301	2
	6/18	0.477	42
	6/24	0.602	36
	6/36	0.778	22
	6/9	0.176	18
DME Total			120
Dry Macula	6/12	0.301	10
	6/18	0.477	30
	6/6	0	34
	6/9	0.176	46
Dry Macula Total			120
Total			240

Table 3: *Number&percentage distribution of BCVA among studied group.*

Nassar color plates			
diagnosis	**Nassar color plates**	**Total**	**percentage**
DME	mild tritan	14	11.66%
	moderate tritan	40	33.33%
	normal	6	5%
DME Total		60	50%
Dry macula	normal	60	50%
Dry macula total		60	50%
Grand Total		120	100%

This table shows that mean duration of DM among moderate tritan by NASSAR color plate is significantly higher than normal tritan patients (P<0.05).

This table shows that percentage of BCVA at 6/6 & 6/9 is significantly higher among normal patients by NASSAR color plate (P<0.05), while, percentage of BCVA at 6/24 & 6/36 is significantly higher among moderate tritan by nassar color plate (P<0.05).

Table 4: *Comparison between NASSAR color plate score regarding demographic data.*

demographic data	Normal (n=66)		Mild tritan (n=14)		Moderate tritan (n=40)		X^2	P-value
	No	%	No	%	No	%		
Male	30	45.5	14	100	16	40	8.07	<0.05
Female	36	54.5	0	0	24	60		
Age in years (X±SD)	39.06±6.02		43.43±4.58		43.5±3.86		5.28*	P_1<0.05 P_2<0.05

*ANOVA (f) test

P_1 between normal&mild tritan

P_2 between normal&moderate tritan

Table 5: *Comparison between NASSAR plate score regarding duration of DM.*

Duration	Normal (n=66)	Mild tritan (n=14)	Moderate tritan (n=40)	ANOVA test
Mean±SD	12.79±2.48	13.57±1.62	14.75±2.67	3.92
P-value		P_1>0.05	P_2<0.05	

P_1 between normal & mild tritan

P_2 between normal & moderate tritan

Table 6: *Comparison between NASSAR color plate regarding BCVA.*

BCVA		Normal (n=66)		Mild tritan (n=14)		Moderate tritan (n=40)		X^2	P-Value
Snellen	LogMAR	No	%	No	%	No	%		
6/6	0.00	34	14.17%	0	0.00%	0	0.00%	8.105	<0.05
6/9	0.176091259056	58	24.17%	10	4.17%	0	0.00%	12.265	<0.001
6/12	0.301029995664	10	4.17%	2	0.83%	0	0.00%	2.49	>0.05
6/18	0.47712125472	30	12.50%	14	5.83%	28	11.67%	2.61	>0.05
6/24	0.602059991328	0	0.00%	2	0.83%	34	14.17%	18.325	<0.001
6/36	0.778151250384	0	0.00%	0	0.00%	18	7.50%	9.74	<0.05

DISCUSSION

Various colour vision assessments, such as FM100, anomaloscope and others, have shown correlation between colour vision deficits and diabetic retinopathy. However, most conventional colour discrimination tests, such as FM 100 hue and Farnsworth-Lanthony D-15 tests, are inadequate and also not sensitive enough for widespread screening purposes. For example, in 1985, Green et al.,[7] examined the FM 100 hue test as a screening device for STDR. Although they found the test to have a sensitivity of 73% and a specificity of 66%, they concluded that the test was not sensitive enough for the detection of severe retinopathy. In a similar study, Bresnick et al.,[8] reported a sensitivity of 65% and a specificity of 59% and concluded that the FM 100 hue test was cumbersome to administer and score in an office setting. In view of this, could a more user friendly and sensitive colour vision test improve the sensitivity and specificity of the screening procedure? A study by Maár et al.,[9] reported a sensitivity and specificity of 88.9% and 93.3% respectively in detecting diabetic macular oedema using the Mollon-Reffin "Minimalist" test.

In our study we use the nassar colour plate with a Sensitivity 90%, Specificity 100% and Accuracy 95% in detecting diabetic macular oedema.

For a screening programme to be cost effective, the costs of early detection of a target disease need to be balanced with the costs of late detection. These costs determine whether screening for the disease is economically viable. In a diabetic screening setting, the costs of early detection involve the screening examination, patient investigation, treatment and re-examination of false positive patients. These costs need to be balanced against the costs of late detection which include the human and economic consequences of secondary complications of the disease, the loss of potential earnings and the provision of social/housing services that may be incurred.[5]

In our study the cost was cheap and we can detect early cases of DME without the use of expensive investigative examinations as compared to Shin YJ et al.,[10] in 2014 who used computerized color vision test for detection of diabetic macular edema with an OCT and reach a conclusion that the observed correlation between Seoul National University computerized color vision test (SNU) error scores and foveal thickness indicates that the SNU test may be useful for detection and monitoring of diabetic macular edema.

CONCLUSION

The Nassar color plate is a cheap and effective test to early detect macular edema and recommend to be used in all ophthalmic primary examination especially in areas far away from OCT and FFA.

Table 7: *Validity of both Nassar color plates in relation to Fluorescein angiography in diagnosing cases of diabetic retinopathy.*

Validity	%
Sensitivity	90%
Specificity	100%
Accuracy	95%
+ve p-value	100%
-ve p- value	91%

Sensitivity 90% and Specificity 100%.

REFERENCES/KAYNAKLAR

1. DeMonasterio FM, Schein SJ, McCrane EP. Staining of blue-sensitive cones of the macaque retina by a fluorescent dye. Science. 1981;213:1278-81.
2. de Monasterio FM, McCrane EP, Newlander JK, et al. Density profile of blue-sensitive cones along the horizontal meridian of macaque retina. Invest Ophthalmol Vis Sci. 1985;26:289-302.
3. Davies N , Morland A . Extent of foveal tritanopia in diabetes mellitus. Br J Ophthalmol. 2003;87:742-6.
4. Foulds WS, McCuish A, Barrie T, et al. Diabetic retinopathy in the West of Scotland: its detection and prevalence, and the cost-effectiveness of a proposed screening programme. Health Bull (Edinb). 1983;41:318-26.
5. Ong G L, Ripley L G, Newsom R S B, et al. Assessment of colour vision as a screening test for sight threatening diabetic retinopathy before loss of vision Br J Ophthalmol. 2003;87:747-52.
6. Kohner EM , Porta M. Protocols for screening and treatment of diabetic retinopathy in Europe. Eur J Ophthalmol. 1991;1:45-54.
7. Green FD, Ghafour IM, Allan D, et al. Colour vision of diabetics. . Br J Ophthalmol. 1985;69:533-6.
8. Bresnick GH, Condit R, Palta M, et al. Association of hue-discrimination loss and diabetic retinopathy. Arch Ophthalmol. 1985;103:1317-24.
9. Maár N, Tittl M, Stur M, et al. A new colour vision arrangement test to detect functional changes in diabetic macular oedema. Br J Ophthalmol. 2001;85:47-51.
10. Shin YJ, Park KH, Hwang JM, et al. A novel color vision test for detection of diabetic macular edema. Invest Ophthalmol Vis Sci. 2014;55:25-32.