



A STUDY OF CONTRAST SENSITIVITY CHANGE IN NORMAL INDIVIDUAL AND DIABETIC PATIENTS WITH AND WITHOUT DIABETIC RETINOAPHTHY

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ABSTRACT

INTRODUCTION: Diabetic retinopathy is a common of diabetes mellitus and the leading cause of vision loss in India which is now having epidemic of diabetes. The pathology of this disease is well characterized by microvascular lesions but also includes deficits in visual function, possibly as a consequence of retinal neurodegeneration.

AIMS:

- To examine the contrast sensitivity of the patients with type 2 DM
- To compare the contrast sensitivity changes in patients with diabetic and with healthy subjects

OBSERVATIONS AND RESULT: Mean age group diabetic individuals was 51.42 with SD 9.18 & healthy individual Mean age is 52.96 with SD 9.09. 34 were females and 80 were males taken into the study. Sex ration in diabetic group was male: female was 2.5:1 and healthy individual is 2.1:1. There was no relation between age and CSF(contrast sensitivity function) in present study. Mean CSF of both Eyes of subjects with diabetes was 1.19 and with healthy individual was 1.50, Binocular CSF is more than that of unocular CSF. Mean decimal equivalent visual acuity of diabetic subjects were 0.30 in right eye and 0.26 in left eye which were less than healthy individuals who had 0.21 and 0.15 in respected eye (p value <0.05) suggestive of there was significant relation between visual acuity and diabetic retinopathy patients. Mean decimal equivalent BCVA of diabetic patients was 0.15 and 0.14 in right and left eye where in healthy individuals had 0.07 and 0.05, p value <0.05, which shows significant relation between BCVA and DR. Mean FBS and PP2BS level among diabetic retinopathy had 158.63 and 265.21 and without diabetic retinopathy patients had 113.66 and 179.82 (p value <0.05), which suggest blood sugar levels had significant relationship with diabetic retinopathy. Duration of diabetes had no significant relation with contrast sensitivity. Blood pressure had no significant relationship with contrast sensitivity.

CONCLUSION: Contrast sensitivity testing can be used as a screening method for early diabetic retinopathy changes as it decreases in early diabetic retinopathy changes.

KEYWORDS :

INTRODUCTION

The prevalence of adult diabetes worldwide is anticipated to rise from 4.0% in 1995 to 5.4% by 2025¹. As per the World Health Organization (WHO) estimates, India has 31.7 million diabetic subjects². The prevalence of diabetic retinopathy (DR) in type 2 DM has found to be 35-39% in the United Kingdom Prospective Diabetes Study (UKPDRS) DR is the leading cause of legal and functional blindness for people in their working years³. As per one study conducted in Rajiv Raman in Chennai at Shankara Netralaya in urban health population, prevalence of diabetic retinopathy in general population was 3.5% (95% CI,3.49-3.54). the prevalence of diabetic retinopathy in the population with diabetes mellitus was 18.0% (95% CI, 16.0-20.1)⁴.

A study of health-related visual quality of life (HRQoL) appraises contrast sensitivity (CS) as a newer measure of visual function and its value in determining HRQoL and health utility in comparison to the most standard measure, visual acuity¹.

Hallstedt et al¹ suggested that contrast sensitivity is an indicator of changes in diabetic retinopathy and macular edema, especially at low-to mid-range spatial frequencies. Isolated losses of CS exist in certain diseases, and in many others, loss of contrast sensitivity is more prominent and disturbing to patient than loss of visual acuity⁵.

AIMS AND OBJECTIVES

The present study was undertaken in a tertiary care hospital SMIMER of surat city with following aims and objectives:

- To examine the contrast sensitivity of the patients with type 2 DM
- To compare the contrast sensitivity changes in patients with diabetic and with healthy subjects

METHODOLOGY

A descriptive observational study conducted over 114 patients, presented in eye OPD of SMIMER hospital having diabetes mellitus type 2 and healthy individuals having complain of dimness of vision and other complains included in study.

Inclusion criteria:

- Patients with or without diabetic retinopathy

- Patients having type 1 and 2 DM with
- FBS >126mg/dl, PP2BS >200mg/dl, HBA1c level >6.5 mg/dl
- Patients having untreated PDR and NPDR
- Patients having untreated clinically significant macular edema
- Patients willing and able to provide informed consent
- Age and sex matched controls
- Patients with early cataract

Exclusion criteria:

- Subjects who are unable to provide informed consent
- Patients with pseudophakia
- Patients with diabetes and previous photocoagulation
- Patients with glaucoma
- Patients with undergone LASIK or refractive surgery
- Amblyopic patients
- Other concurrent ocular pathology including infection or trauma

In this study, patients 25 years or older having diagnosis were examined by using Pelli Robson contrast sensitivity charts with help of electronic displays and findings noted.

OBSERVATION AND DISCUSSION

Contrast sensitivity function were assessed with PELLI ROBSON CHART with help of electronic displays. Data were analyzed using chi square test.

Distribution according to age:

Table no. 1 Age distribution

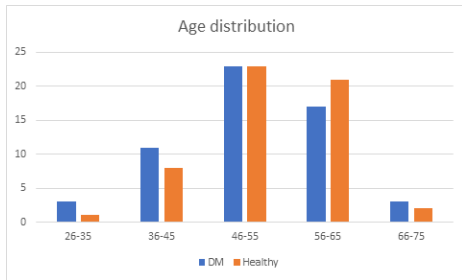
Age in years	DM		Healthy	
	No.	Percentage	No.	Percentage
26-35	3	5.3	1	1.8
36-45	11	19.3	8	14
46-55	23	38.6	23	40.4
56-65	17	29.8	21	36.8
66-75	3	5.3	2	3.5
Total	57	100	57	100

- As per table no. 1 majority of the subjects in the present study

belonged to the age group 46-55 years (36.8%).

- Mean age group diabetic individuals was 51.42 with SD 9.18 & healthy individual Mean age is 52.96 with SD 9.09.
- Total 18 patients with DR among 57 diabetic patients were taken in the study.

Chart No. 1 Age distribution

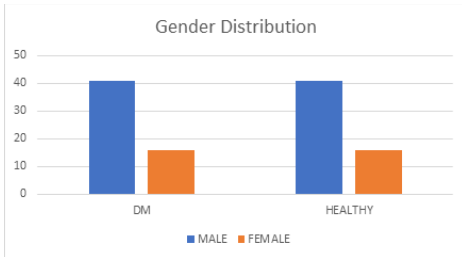


Gender Distribution:

Table no. 2 Gender Distribution

	DM		Healthy	
	No.	Percentage	No.	Percentage
MALE	41	71.9	39	68.4
FEMALE	16	28.1	18	31.6
TOTAL	57	100	57	100

Out of 114 patients, 34 were females and 80 were males taken into the study. Sex ration in diabetic group was 2.5:1 and healthy individual is 2.1:1.



CSF and AGE distribution pattern

Table 3: CSF and age distribution pattern

Age	CSF Right eye		CSF Left eye		CSF both eyes	
	MEAN	SD	MEAN	SD	MEAN	SD
26-35	1.31	0.14	1.31	0.14	1.31	0.14
36-45	1.28	0.12	1.32	0.12	1.32	0.12
46-55	1.28	0.29	1.34	0.18	1.34	0.18
56-65	1.28	0.25	1.28	0.2	1.28	0.2
66-75	1.25	0.32	1.25	0.33	1.25	0.33
Total	1.29	0.3	1.31	0.3	1.31	0.3

P value > 0.05

There was no relation between age and CSF in present study.

Contrast sensitivity and diabetes

Table 4: contrast sensitivity and diabetes

	Diabetes	No. of patients	Mean contrast sensitivity	SD
Right Eye	Present	57	1.1	0.29
	Absent	57	1.47	0.07
Left Eye	Present	57	1.13	0.24
	Absent	57	1.5	0
Both eyes	Present	57	1.19	0.2
	Absent	57	1.5	0

Table 5 : Contrast sensitivity and Diabetes

Diabetes	Contrast sensitivity					
	Right eye		Left eye		Both eyes	
	Intact	Decreased	Intact	Decreased	Intact	Decreased
Present	0	57	0	57	2	55
Absent	51	6	57	0	57	0

P value < 0.05

Mean CSF of Right Eye of subjects with diabetes was 1.10 and with healthy individual was 1.47, Mean CSF of Left eye of subjects with

diabetes was 1.13 and with healthy individual was 1.50, Mean CSF of both Eyes of subjects with diabetes was 1.19 and with healthy individual was 1.50, Binocular CSF is more than that of unioocular CSF.

Above tables shows that there was significant difference exist between the healthy individuals and patients with diabetes and significant reduction in the CSF in subjects with diabetes as compared to healthy individuals.

This justify our study and rejects null hypothesis.

Decimal Equivalent VA in Patients with and without Diabetic Retinopathy

	Diabetes	No. of patients	Mean Decimal Equivalent VA	SD
Right Eye	Present	57	0.3	0.31
	Absent	57	0.21	0.17
Left Eye	Present	57	0.26	0.20
	Absent	57	0.15	0.09

TABLE 7: DECIMAL EQUIVALENT BCVA IN PATIENTS WITH AND WITHOUT DIABETIC RETINOPATHY

Mean decimal equivalent BCVA of Right eye of subjects with diabetes was 0.15(6/9) and with healthy individual was 0.07(6/6p),

Mean decimal equivalent BCVA of Left eye of subjects with diabetes was 0.14 (6/9) and healthy individual was 0.05(6/6p),

P value is less than 0.05 which suggest significant reduction in decimal equivalent BCVA in subjects with diabetes.

Patients` Characteristics

Table 8: patients characteristics

	Diabetic retinopathy	No. of patients	Mean	SD	P value
FBS	PRESENT	19	158.63	17.22	0.013
	ABSENT	95	113.66	22.09	
PP2BS	PRESENT	19	265.21	12.06	0.0004
	ABSENT	95	179.82	60.97	
SYSTOLIC	PRESENT	19	149.15	8.11	0.8
	ABSENT	95	149.62	7.54	
DIASTOLIC	PRESENT	19	83.89	1.82	0.84
	ABSENT	95	84	3.26	

- Mean FBS among diabetic retinopathy patients was 158.63 and patients without diabetic retinopathy was 113.66 here p value was <0.05, which is suggestive of significant association between high FBS level and diabetic retinopathy.
- Mean PP2BS among diabetic retinopathy patients was 265.21 and patients without diabetic retinopathy was 179.82 here p value was <0.05 which is suggestive of significant association between high PP2BS and diabetic retinopathy.
- Mean systolic BP was 150 and diastolic BP was 84 with p value >0.05 which shows there isn't significant association between two variables in present study.

FBS and CONTRAST SENSITIVITY

Table 9: FBS value and Contrast sensitivity

FBS	CONTRAST SENSITIVITY					
	Right Eye		Both Eye		Left Eye	
	Intact	Decreased	Intact	Decreased	Intact	Decreased
>125	0	54	0	54	2	52
<125	51	9	57	3	57	2

P value < 0.05

Here, p value is less than 0.05, which shows significant association between FBS level and contrast sensitivity, the CSF decreases as metabolic control of blood sugar level fluctuates.

PP2BS and CONTRAST SENSITIVITY

Table 9: PP2BS value and Contrast sensitivity

PP2BS	Contrast Sensitivity					
	Right Eye		Left Eye		Both Eye	
	Intact	Decreased	Intact	Decreased	Intact	Decreased
>125	0	54	0	54	2	52
<125	51	9	57	3	57	2

>200	0	57	0	57	2	55
<200	51	6	57	0	57	0

P value <0.05

Here, p value is less than 0.05, which shows significant association between PP2BS level and contrast sensitivity, the CSF decreases as metabolic control of blood sugar level fluctuates.

Duration of diabetes and CSF

CONTRAST SENSITIVITY	DURATION	NO. OF PATIENTS	MEAN	SD
RIGHT EYE	<5 YEARS	107	1.49	0.06
	>5 YEARS	7	1.5	0
LEFT EYE	<5 YEARS	107	1.5	0
	>5 YEARS	7	1.5	0
BOTH EYES	<5 YEARS	107	1.5	0
	>5 YEARS	7	1.5	0

P value >0.05

Here, P value is more than 0.05 which is suggestive that duration of diabetes mellitus doesn't have significant association with contrast sensitivity function. As most of the patients include in present study were having diabetic duration of less than 10 years, no association between CSF and duration of diabetes was found.

DISCUSSION

Sokol et al⁷ observed that contrast sensitivity measurements were obtained from 64 patients with insulin-dependent (IDDM) and non-insulin-dependent (NIDDM) diabetes mellitus who had normal Snellen acuity and minimal or no visible diabetic retinopathy. Contrast thresholds were determined for stationary gratings at six spatial frequencies, ranging from 0.5 to 22.8 cycles/degree (c/deg), and for 1.0-c/deg gratings phase-alternated at 15 Hz. Data from each group of diabetic patients were compared with data from age-matched normal subjects. We found that (1) patients with IDDM and no retinopathy had normal contrast sensitivity, (2) patients with NIDDM and no retinopathy had abnormal contrast sensitivity at only one spatial frequency (22.8 c/deg), and (3) patients with NIDDM and background retinopathy had abnormal contrast sensitivity at all spatial frequencies tested. We also found a dissociation of Snellen acuity and contrast sensitivity, indicating that contrast sensitivity can be used as an early index of changes in the retina not demonstrated by measurements of visual acuity.

Liska⁸ done study on group consisted of 48 IDDM patients (94 eyes) without diabetic retinopathy and with Snellen BCVA > 1.0. The control group (56 normals, 98 eyes) was age and BCVA matched. Contrast sensitivity functions (CSFs) were estimated using the VCTS 6500 board. The standardised measurement procedure was performed. The value of the threshold contrast sensitivity was obtained for five spatial frequencies (1.5-3-6-12-18 c/deg). Other data was collected (duration of diabetes, BCVA, funduscopy, fluoresceine angiography, HbA1C). Highly statistically significant decrease of the CSFs in all spatial frequencies in the study group was obtained. Correlation between duration of the diabetes and impaired degree of CSFs was present in the middle spatial frequency. No significant changes in CSFs were found among patients with pathological value of glycated hemoglobin HbA1c (> 7.8%). If compared with routinely used Snellen visual acuity, the CSFs are more complex descriptors of the subjects vision abilities. IDDM has an influence on these sensitive functions, especially during examination in the middle spatial frequency of 6 and 12 c/deg, before disturbing visual acuity and before changes in the retinal morphology. Decrease of CSFs was influenced mainly by the patients' age and partially (in the middle spatial frequency) by the IDDM duration.

SUMMARY

Majority of the subjects in the present study belonged to the age group of 46-55 years (38.6%). Mean age of diabetic individuals was 51.42 with SD 9.18 and healthy individual mean age is 52.96 with SD 9.09. Total 18 patients with DR, among 57 diabetic patients, were taken into study. Sex ratio in diabetic group is 2.5:1 and in healthy individuals is 2.1:1. There was significant reduction in contrast sensitivity function in subjects with diabetes as compared to healthy individuals (p value <0.05). There was significant reduction in decimal equivalent VA

in subjects with diabetes (p value <0.05). There was significant reduction in decimal equivalent BCVA in subjects with diabetes (p value <0.05). there was significant association between high FBS and diabetic retinopathy. There was significant association between FBS and PP2BS level with contrast sensitivity, the contrast sensitivity function decreases as metabolic control of blood sugar level fluctuates (p value <0.05). Duration of diabetes mellitus doesn't have significant association with contrast sensitivity function.

REFERENCES

- King H, Aubert RE, Herman WH. Global burden of diabetes, 1995-2025: prevalence, numerical estimates, projections. *Diabetes care* 1998;21:1414-31.
- Wild S, Roglic G, Green A. Global prevalence of diabetes, estimates for year 2000 and projections for 2030. *Diabetes Care* 2004;27:1047-53.
- Contrast sensitivity in diabetes with retinopathy and cataract by Sharon howes, Terry Caelli and Paul Mitchell
- Prevalance of diabetic retinopathy in India. (Shankar Netralaya and Diabetic retinopathy Epidemiology and macular genetics report 2) *Ophthalmology* 2009;116:311-318;2009 by American Academy of Ophthalmology.
- Sokol S, Moskowitz A, Skarf B, Evans R, Molitch M, Senior B. Contrast sensitivity in diabetics with and without background retinopathy *Arch Ophthalmol.* 1985 Jan;103(1):51-4.
- Liska V1, Dostálek M Are contrast sensitivity functions impaired in insulin dependent diabetics without diabetic retinopathy? *Acta Medica (Hradec Kralove).* 1999;42(4):133-8.