Contrast sensitvity and photostress recovery time in prediabetics

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1 Introduction

Prediabetes is explained by glucose level in the blood which is higher than the normal but below the threshold for type 2 diabetes mellitus. A load of prediabetes is massive: the present prediction across the globe is to affect 373 million people and this figure is likely to increase to 587 million (8.3% of the world adult population) by 2045 [1].

The age of the public worldwide is increasing and hope for life is also rising. The wide spread of obesity and heart disease, together with diabetes is a result of current lifestyle habits. Although in prosperous countries, where diabetic retinopathy (DR) is not a generally noteworthy source of blindness, the figure variation and western culture of nourishing and life practices are generating an evolving illness that includes diabetes and diabetic retinopathy. Early perception and potential management can reduce disease elevation, cure visual loss, and hence decline later reliance on health care services [2].

The changes in the pre-diabetic stage are described as the point at which neuronal damage starts leading to the actual structural or vascular changes, this leads us to believe that prevention of vision loss due to diabetic retinopathy can be taken at early neuroprotective measures in pre-diabetics.
Contrast sensitivity tests are believed to be more sensitive to early eye disease than visual acuity. Contrast sensitivity testing is recognized for early diagnosis of ocular disease and treatment [3].
The photo stress recovery time evaluation procedure is also known as a photo stress exam. 15–30 seconds is considered as normal recovery time [4].
To prevent blindness and severe vision impairments as a starting point, screening of all diabetics for diabetic retinopathy is recommended. The study results assist in considering the selection procedures in preliminary findings of the pre-diabetes phase in diabetes and this will lead to timely recommendations to prevent the visual loss.

2 Materials and Method

The descriptive cross-sectional study was carried out by using the non-probability convenient sampling technique. The study was carried out at the general opd departments of Al-Shifa Trust eye care hospital from December 2021 to May 2022.

Subjects without diagnosed diabetes include aged 30 to 50 years.Pre-diabetic based on their HbA1C values. According to the American Diabetic Association A1C values ranging between 5.7%–6.5% were the target population of this study.This study followed the principles outlined in the Declaration of Helsinki, and also the permission was taken from the hospital and every participant before inclusion in the study.

Inclusion and Exclusion

The inclusion criteria were (1) Participants without diagnosed diabetes aged 30 to 50 years, and (2), Pre-diabetic based on their HbA1C values. According to the American Diabetic Association, A1C values range between 5.7%–6.5%. The exclusion criteria were (1) Subjects having known diabetes with an HbA1C value above 6.5., (2) Visual acuity below 0.1 Log MAR equivalent to Snellen chart vision 20/25 or 6/7.5., and (3) All visual and systemic diseases patients.

Ocular Examination

Demographic data were recorded on self-designed Performa. Respondents were evaluated for inclusion criteria by passing through a process of the routine eye examination. From the selected subjects blood sample was taken to calculate the HbA1c Value. After the value was calculated they were categorized as normal, pre-diabetics, or diabetics. After that participants which fall in the prediabetes category underwent a Contrast Sensitivity Function assessment using a Pelli– Robson chart. For determining Photo stress recovery time, the macular area was directly exposed to the light of a direct ophthalmoscope for 30 seconds at a distance of 5cm from the nasal side, whereas the alternate eye remained covered. The time to recover was noted using a stopwatch.

Statistical Analysis

The data analysis was performed using the Statistical Package of Social Sciences (SPSS) version-22. For descriptive analysis, continuous variables were presented in the form of mean and standard deviation, whereas categorical or continuous variables were reported in the form of frequency and percentages. An association was found between the

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mean values of prediabetes patients and calculated the mean value of their photo stress recovery time and contrast sensitivity function by using a one-sample t-test.

Results

A total of 350 patients were assessed out of which 100 patients (200 eyes) were pre-diabetics. These patients underwent the contrast sensitivity function test and photo stress recovery test.

Variables	Frequency N	Percentage %
Age		
30-35	38	19
36-40	54	27
41-45	56	28
46-50	52	26

Descriptive Analysis

Demographic and clinical characteristics of the study groups show out of a total 99 (49.5%) were male whereas 101 (50.5%) were female patients. The majority of the patients 56 (28%) were from the age group 41-45 years followed by 54 (27%) were belong to 36-40 years. Further details are given below

Table 1: Socio-demographic characteristics of the patients (N=200)

Based on inclusion criteria, data for CSF and PSRT were analyzed for 200 eyes. The mean photo stress recovery time was 29.0±0.30 seconds whereas the mean contrast sensitivity was 1.54±0.50. Details are given below.

Table 2: Clinical Parameters of Patients

Sr No.	Variables	Mean	Standard Deviation
1	HbA1c	6.09	0.32
2	Photo stress recovery time	29.0	5.70
3	Contrast Sensitivity Function	1.54	0.28

The mean HbA1c value shown in table 2 is 6.09 ±0.32. According to the American Association, the pre-diabetic range is >5.7 to 6.5. The 14 % (28) participants of the study have HbA1c values was 5.8 and 6.5. 21.5%(43) have a 1.20 contrast sensitivity function while only 3%(6) have a Contrast sensitivity function of 2.10. The maximum delay in photostress recovery time was 37 seconds.

Table no 3

Table no 3 shows the frequencies of the two practical tests applied to the pre-diabetic participants. This table shows that out of 200 eyes 55.5 % of the individual eye have delayed photostress recovery time while the 53 % of the eyes have decreased contrast sensitivity.

Inferential Analysis:

A statistically significant association was found between the mean values of pre-diabetic patients and the calculated mean value of their photo stress recovery time and contrast sensitivity function with a p-value<0.05

Table 4: One-Sample t-Test

Sr. No	Variable	Test value	t	P-value	95% Confidence interval	
					Lower	Upper
1.	photostress Recovery Time	41.63	-31.117	0.000*	-13.409	-11.891
2.	Contrast sensitivity function	1.64	-4.745	0.000*	-.1355	-.05605

***Statistical Significant p-value <0.05**

Discussion

The descriptive cross-sectional study was carried out by using the Non- probability convenient sampling technique. Based on inclusion criteria, data for CSF and PSRT were analyzed for 200 eyes. The mean of the photostress recovery time was 29.0±0.30 seconds whereas the mean of contrast sensitivity was 1.54±0.50.

The loss of optical function in persons with and without diabetes, retinopathy has been considerably reported in the literature. This study shows that those individuals with prediabetes had lost CSF and also has a delay in photostress recovery time. A study on pre-diabetics showed that the mean contrast sensitivity function is 1.64 and 41.63 seconds is photo stress recovery time, a similar pattern of reduced contrast and change in photostress has been noticed in the

present study. The present study reported the mean of CSF and PSRT at 1.54 and 29.0 seconds respectively. In the current study, CSF was 1.54 log units in the pre-diabetes group being much lower than the non-diabetic group and also below the age-associated data reported in literature [5]. Similarly, the ongoing study CSF is 1.54 underneath than normal range as shown by one of the studies in pre diabetic group in which CSF was 1.64 log units in the prediabetes group and 1.61 log units in those persons with investigated diabetes [6].

Parvocellular ways are responsible for higher spatial frequencies have been seen, one study on diabetic and contrast functions reported lower CS in cases with no diabetic retinopathy with concluded Magno- and parvocellular pathways. [28] Likewise, one more study information showed lower CS in prediabetes surmises that magnocellular and parvocellular pathways would be pretentious because of impaired fasting glucose values in prediabetes [6]. The same results have been noticed in the present study.

Photo stress recovery time has been described to be the most reliable test for maculopathy function. One of the research information showed notable depletion in PSRT in those having prediabetes. The standardized data for PSRT measured, with the help of direct ophthalmoscopy for age-group ≤50 years is 35 seconds. The study data showed that in the category of prediabetes, recovery time was delayed by 6.1 seconds [6]. While in the current study the highest delay measured was 7 seconds.

In this study 55.5% of the individual eye have delayed photostress recovery time, similarly in a study "the macular recovery test after stress in normal and diabetic subjects" also showed delayed PSRT in diabetic individuals [7]. Likewise, a study was organized in which the patients with untreated proliferative diabetic retinopathy and the ones who go through the process of pan-retinal photocoagulation express most inner retinal dysfunction, lower contrast sensitivity, extended photostress recovery time, go with alterations in inner and outer retinal structure [8].

A study was managed in which a macular photo stress test was performed on diabetic retinopathy patients and age-related macular deterioration. This study suggested that there should be delayed photostress recovery time in macular disease [9].

In literature one of the study data recommended that CSF and delayed PSRT seen in prediabetes can give helpful clinical insight into early alterations before diabetes and microvascular damage are incurred [6]. Similarly, 53% decreased contrast sensitivity and 55.5% delayed photostress recovery time have been observed in the current study which can be productive in diagnosis beforehand and can give important intuition to cure the blindness of diabetic retinopathy.

Therefore, to excel the quality of vision in individuals at the prediabetes stage. If CSF and PSRT become a part of the routine eye examination with the inclusion of guidance for lifestyle correction [10].

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Conclusion

Contrast sensitivity and photo stress recovery time could be included in routine eye examination in order to rule out reduced CSF and delayed PSRT seen in prediabetes this could give clinical discernment into initial variations seen in earlier diabetes and microvascular impairment.

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