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Correlation between CFF and HbA1C among type 2 diabetic subjects

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Abstract

Introduction: Diabetes has become a worldwide epidemic and need to reduce the morbidity due to this disease has become the need of hour. India ranks first in diabetic population and diabetic retinopathy affects third of all diabetic patients and its prevalence increases with the duration of diabetes both in urban and rural areas.[1,2]

So we aimed to correlate Critical flicker fusion frequency (CFF) and HbA1C among the type 2 diabetic subjects. Noninvasive simple method of assessing retinal function was applied.

Study Design: Cross sectional observational study.

Materials and Method: Subjects n= 50 males, Age group 40-50 years. All participants had a sedentary life style, Blood pressure and HbA1C were measured. Subjects with history of epilepsy, neurological diseases, peripheral vascular disease, alcoholics, smokers and any other illness or medications that affects CFF were excluded. CFF was measured using in house built LED based CFF M1model instrument.

Results: Mean age = 46 ±82 years,
Mean SBP = 117± 15mmHg, Mean CFF = 35 ± 3Hertzs,
Mean HbA1C = 6.6 ±.3%. Pearson correlation was applied. CFF correlated negatively with HbA1C with r value of -0.499.

Conclusion: We conclude that increased blood glucose affects the retinal functions and decreases the critical flicker fusion frequency indicating the failure of retina to differentiate the flicker in higher frequencies.

Keywords: CFF, HbA1C, Type 2 diabetics.

Introduction

The frequency at which lowest level of continuous flicker that is perceived as a steady source of light is Critical flicker fusion (CFF) frequency. The ability to resolve flicker is thought to be limited by the early visual system.[3] CFF is not affected by medial opacities and detects macular degeneration even in the presence of cataract. Posterior segment eye disease can impair critical flicker fusion (CFF) frequency.[4,5] Diabetes affects the retina with duration of disease and poor glycemic control.[6] We correlated HbA1 the gold standard parameter of glycemic control[7] with simple, noninvasive cost effective test like CFF to assess retinal function which can prevent microvascular complication and ocular morbidity in type 2 diabetes in early stage.

Aim

To correlate CFF with HbA1C among type 2 diabetic patients.

Study Design

Observational/cross sectional study.

Materials and Method

All participants gave a written informed consent to participate in this study. Information details about sociodemographic characteristics, disease history, family history, alcohol consumption, cigarette smoking, drug intake and occupational history were obtained by a structured questionnaire. All participants had a sedentary lifestyle. Institutional ethics committee clearance was obtained.

Subjects

Inclusion criteria: 50 males with type 2 diabetes, Age = 40 - 50 yrs, Blood pressure = < 140/90 mmHg, HbA1C value = 6-7.5% duration of diabetes 8-10 years.

Exclusion Criteria: Subjects with history of epilepsy, neurological disorders, peripheral vascular disease, smokers, alcoholics and any other illness and medications that affects arterial compliance.

Blood pressure was measured using a standard mercury sphygmomanometer.

HbA1C was measured for assessing glycemic status.

Measurement of CFF: CFF was measured using in house built LED based CFF M1 Model instrument. CFF M1 Model instrument has 2 components. One component has a flickering light source placed in a board of white background (to provide central field stimulation). Light source is presented separately to the individual eye by covering the other eye. A monochromatic light, red light (light emitting diode) with wave length 630 nm is used as it is perceived for longer time in the retina.[8] There is no delay period for switching on as the light source is a solid state LED. Flickering of the light source is designed so that the on period and off period are kept equal. Second component is a variable frequency square wave oscillator which can give oscillations in the range of 10- 80 hertz with an accuracy of 0.5 hertz. To measure CFF frequency,

examination room was partially illuminated, subject was made to sit comfortably and presented with a red light source at a distance of 25-30 centimetres. Frequency of oscillations were gradually increased. Subject was instructed to respond when the flickering light source appeared as a single fused light and that particular frequency is critical flicker fusion frequency. The frequency was measured from the recorded data using Audacity software. CFF was measured in right and left eye separately and average of two frequencies was considered as final CFF value for that subject.[9]

Result

Statistical analysis was done Using SPSS Software version 16.0. The descriptive statistics of Age, CFF, HbA1C, Systolic blood pressure are mentioned in (Table 1). Pearson correlation was applied. Correlation between CFF with HbA1C analyzed among study group and it showed a negative correlation. (Table 2).

Table 1: Descriptive statistics

N= 50	Mean ± SD
Age (yrs)	46.8±3
CFF (Hertzs)	35.6 ±3
HbA1C (%)	6.6 ±.3
Systolic blood pressure (mm Hg)	117± 15
Diastolic blood pressure (mm Hg)	78±11

Table 2: Correlation between CFF with HbA1C

N=50	HbA1C % r value	HbA1C % p value
CFF (Hertzs)	0.499	.000

Discussion

Our study showed a negative correlation of CFF and HbA1C indicating decreased ability to differentiate the flicker with increasing frequencies in subjects with inappropriate control of blood glucose. Recent data by Du Y, Veenstra et al shows that photoreceptors are the major site of superoxide generation in diabetes and lead to the formation of degenerative changes like neovascularisation and other related changes.[10] As stated by Rubin et al cone photoreceptors capable of achieving higher CFF than rods and contemporaneous measure of rod and cone function can facilitate characterization of a retinal degeneration.CFF can assess the function of photoreceptors and thought to be a potential vision test even in the presence of cataract and medial opacity.[11] Guillermo et al state that CFF measures the temporal resolution at a high modulation depth, and it is so resistant to cataract-induced changes that adversely affect the spatial processing system.[12] Livingstone MS et al state significant association between visual acuity and CFF in subject with macular degeneration.[13]. Rods and cones are affected in diabetes and their functions can be assessed by measuring critical flicker fusion frequency. Hence Correlating HbA1C and CFF can assess the posterior segment of the eye and early retinal changes.

Conclusion

CFF correlated negatively with HbA1C in type 2 diabetic subjects.

Implication of Study

Clinical goal of diabetes management aims at giving good quality of life to diabetic subjects. Ocular morbidity plays key role which can be reduced by assessing the retinal function through this simple test like CFF. Life style and medication modifications can be advised to achieve a good glycemic control.

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Conflict of interest: None.

References

1. Ding J, Wong TY. Current epidemiology of diabetic retinopathy and diabetic macular edema. Curr Diab Rep. 2012;12:346–54.
2. King H, Aubert RE, Herman WH. Global burden of diabetes,1995–2025 prevalence, numerical estimates and projection. Diabetes Care. 1998;21:1414–31.
3. Eysel UT, Burandt U. 2001. Fluorescent tube light evokes flicker responses in visual neurons. Vision Res 24:943–948.
4. Hema Shankar, BMBS, MA, Konrad Pesudovs, PhD, Critical flicker fusion test of potential vision J CATARACT REFRACT SURG - VOL 33, FEBRUARY 2007.
5. NakamuraM, Yamamoto M. Variable pattern of visual recovery of Leber's hereditary optic neuropathy. Br J Ophthalmol 2000;84:534–535.
6. Stefánsson E, Bek T, Porta M, Larsen N, Kristinsson JK, Agardh E. Screening and prevention of diabetic blindness. Acta Ophthalmol Scand. 2000;78:374–385.
7. Sato A, [Indicators of glycemic control --hemoglobin A1c (HbA1c), glycated albumin (GA), and 1,5-anhydroglucitol (1,5-AG)]. Rinsho Byori. 2014 Jan;62(1):45-52.
8. Hema Shankar, BMBS, MA, Konrad Pesudovs, PhD, J Critical flicker fusion test of potential vision, *J Cataract & Refract Sur*, 2007;33:232-239.
9. R. Niruba, Babitha. R, K.N. Maruthy, Correlation between Critical flicker fusion frequency (CFF) and Systolic Blood pressure Volume:1, Issue:1, October 2013,page 11-14.
10. Du Y, Veenstra A, Palczewski K, et al. Photoreceptor cells are major contributors to diabetes-induced oxidative stress and local inflammation in the retina. Proc Natl Acad Sci USA. 2013;110:16586–16591.
11. Rubin GR, Kraft TW. Flicker assessment of rod and cone function in a model of retinal degeneration. Doc Ophthalmol. 2007 Nov;115(3):165-72. Epub 2007 Aug 3.
12. Guillermo Bueno del Romo; William A. Douthwaite; David B. Elliott, Critical Flicker Frequency as a Potential Vision Technique in the Presence of Cataracts Visual Psychophysics and Physiological Optics | March 2005.
13. Livingstone MS, Hubel DH. Psychophysical evidence for separate channels for the perception of form, colour, movement, and depth. *J Neurosci*. 1987;7:3416–3468.