



Assessment of Visual Reaction Time in Controlled and Uncontrolled Type 2 Diabetic Patients.

KEYWORDS

Visual Reaction Time, T2DM, Glycated hemoglobin

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ABSTRACT

The measurement of Visual Reaction Time has been used to evaluate the processing speed of Central Nervous System and the co-ordination between the sensory and motor system. Diabetic neuropathy is a disorder of the nerve caused by diabetes mellitus which may be diffused or focal. There for there is a need for tests to identify the affect of hyperglycemia and diabetes control on nervous tissue at the early stage. The present case control study was conducted at diabetic OPD at civil hospital, on 20 Type2 Diabetes Mellitus patients with controlled diabetes (HbA1c <7 %), 20 T2DM patients with uncontrolled diabetes (HbA1c ≥7 %) and 20 normal healthy subjects without diabetes and hypertension ,who were right handed and age between 40 to 50 years. Blood samples were obtained in the fasting state for estimating fasting blood sugar (FBS) and Glycated hemoglobin (HbA1c).The subject's visual reaction time was measured by software. Statistical analysis was done by z- test. There was significant positive correlation between HbA1c and visual reaction time. In this study we found that diabetics with good glycemc control had significantly shorter visual reaction time. T2DM patients manifest with slowing reaction time that is associated with poor metabolic control.

INTRODUCTION:

Type 2 Diabetes mellitus (T2DM), the most common endocrine disorder due to insulin resistance is responsible for significant morbidity and mortality because of various complications that it is associated [1].

One of the micro vascular complications of diabetes, include neuropathy. Neuropathy severity is related to duration and degree of glycemc control[2-3].

Diabetic neuropathy (DN) is a disorder of the nerve caused by diabetes mellitus which may be diffused, or focal [4]. Therefore, there is a need for tests to identify DN before the development of serious complications like cognitive disabilities and diabetic foot. Reaction time (RT) is an index of processing ability of the central nervous system (CNS). It is used in experimental physiology to assess sensory-motor performance. It is the time interval between the onset of a signal (stimulus) and the initiation of a movement response. [5]. A stimulus which can be of any modalities of sensory input like visual, auditory, pain, touch or temperature and the subsequent behavioural response to occur. The behavioural response is typically a button press but can also be an eye movement, a vocal response, or some other observable behaviour [6]. This study intended to examine the visual reaction time in T2DM patients and compare with the HbA1C.

MATERIALS AND METHOD

The present case control study was conducted in diabetic OPD at civil hospital Ahmedabad. It was approved by ethical committee. The study group and controls were selected from OPD at civil hospital. The subjects belonged to the age group between 40 to 50 years, History and a written informed consent were obtained by a structured questionnaire.

Controls: 20 healthy volunteers with no history of diabetes, Hypertension, visual disturbance, alcohol intake, smoking, neural disease, muscle disease and history of recent illness.

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Cases: 20 T2 DM patients with controlled diabetes (HbA1c<7%) and 20 T2 DM patients with uncontrolled diabetes (HbA1c≥7%).

Inclusion criteria: Subject with Type 2 diabetes on oral medication, duration < 10 years.

Exclusion criteria: subjects on insulin, complicated cases of diabetes, alcoholics, smokers subjects with visual disturbance, any muscle weakness, any other illness and diabetes >10 years.

Blood sample were collected in the fasting state for estimating fasting blood sugar (FBS) and Glycosylated hemoglobin (HbA1c). Fasting blood sugar (FBS) and post prandial blood sugar (PPBS) have been estimated by Glucose Oxidase-Peroxidase (GOD-POD) method, Glycosylated Haemoglobin has been estimated by Cation exchange resin method, using Glycosylated Haemoglobin kit.

HbA1c was done by NYCOCARDDIAGNOVA. Nycocard HbA1c test is point-of-care rapid test and provides an accurate result within three minutes during patient consultation.

VRT : VRT was measured by a reaction time software indigenously prepared in computer programming language visual basic 6. None of the subjects had seen or worked on the apparatus of reaction time before the test. So each subject were made familiar with the apparatus. All the reading were taken between 9-10 am in the morning in a quiet room. Green light stimuli were selected for recording VRT. As soon as the stimulus was perceived by the subjects, they were asked to respond by pressing the response switch by index finger of dominant hand. Three readings of each stimulus were noted in millisecond and average reading was taken. Data was analyzed statistically by ANOVA. Distributions were described as means and standard

deviations.

AIMS AND OBJECTIVES

To highlight the importance of visual reaction time in routine examination of diabetic subjects and thus detect neuropathic changes earlier.

Objectives:

- 1) To measure and compare VRT in normal subjects , controlled diabetics and uncontrolled diabetics.
- 2) To correlate VRT with HbA1c level in diabetics.

OBSERVATIONS AND RESULTS

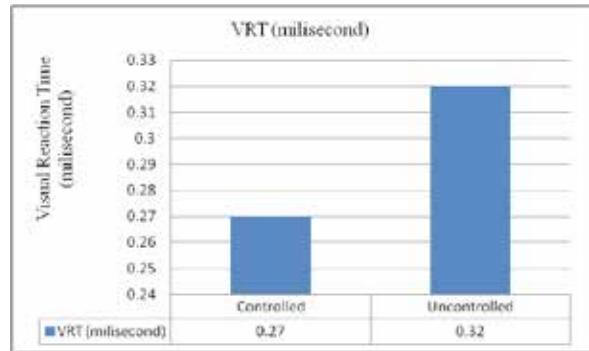
Table 1 shows comparison of various parameters in normal subjects , controlled diabetics and uncontrolled diabetics. There was no significant difference in age in these groups. There was significant difference in FBS, PPBS, HbA1c and VRT between normal and controlled diabetic subjects with p value <0.0001.

PARAMETERS	NORMAL SUBJECTS - MEAN±SD	CONTROLLED DIABETIC SUBJECTS - MEAN±SD	UNCONTROLLED DIABETIC SUBJECTS - MEAN±SD
AGE(years)	44.4 ± 2.96	45.55 ± 2.74	44.6 ± 2.98
FBS(mg/dl)	79.55±5.85	106.75±21.75	151.2±48.67
PPBS (mg/dl)	90.45±5.08	171.6±22.8	238.8±64.61
HbA1c(%)	5.33±1.23	6.4±0.35	9.61±1.51
VRT(millisecond)	0.25±0.034	0.27±0.036	0.32±0.024

Table 2 shows comparison of Blood Sugar Levels among controlled Diabetics and uncontrolled Diabetics. There was a significant difference in FBS, PPBS, HbA1c between controlled and uncontrolled diabetic subjects.

BLOOD SUGAR TEST	CONTROLLED AND UNCONTROLLED DIABETIC SUBJECTS(F VALUE)	P VALUE
FBS	-3.729	<0.0002
PPBS	-4.40	<0.0001
HbA1c	-9.26	<0.0001

Figure 1 shows comparison of visual reaction time in controlled and uncontrolled diabetics. Figure show significant difference in VRT between controlled and uncontrolled diabetics with p value 0.000.



DISCUSSION

In the view of the rise in diabetic population, further rise in complications is expected and thereby increasing the morbidity and mortality.

Subjects with type II diabetes on oral medication all had mild, but measurable peripheral neuropathies which may affect reaction times [7]. Reaction time has physiological significance and is a simple and non-invasive test for peripheral as well as central neural structures [8]. Therefore, this study was undertaken to find the utility of reaction time parameters in T2DM patients to identify the early onset of neuropathy. The studies have showed that T2DM patients without glycemic control had longer visual reaction times which were statistically significant. This is in accordance with the previous studies [9,10].

Also, there was significant positive correlation between HbA1c and visual reaction time parameters which mean poor glycemic control had an adverse effect on reaction time parameters. The comparison of various parameters was also made between the diabetics with good glycemic control (HbA1c<7%) and without good glycemic control (HbA1c≥7%). Diabetics with good glycemic control had significantly shorter visual reaction time indicating the importance of good metabolic control. Reaction times study is a physiological tool which is an index of long duration of health status and HbA1c, an indicator of long duration of glycemic control [11]. Improvement on the reaction time means reversibility of the neuropathic changes to the T2DM patients. It has been shown that reaction times can be improved by various forms of exercises like yoga [12]. Being a cross sectional study is the limitation of this study. Follow up of the patients after the interventions for glycemic control and exercise can improve this study.

CONCLUSION

We conclude from our present study that, for subjects with Type -2 diabetic on oral medication without diabetic control, visual reaction time is prolonged compared to controlled diabetics and normal individuals, that is associated with poorer metabolic control. Thus, VRT is helpful in identifying early neuropathic affect and after the institution of VRT improvement measures; it can be of useful as a monitoring tool.

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