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A comparative study of Edge light pupil cycle time in type-II diabetes mellitus patients and normal subjects

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Abstract:*Purpose of the study is to compare the pupil cycle time(PCT) of patients with type-II diabetes and healthy control subjects.To analyse the effect of different variables like age, sex, blood sugar,diabetes duration on PCT.Methods- The study was conducted on known type-II diabetes patients attending retina clinic and non diabetic patients attending Eye OPD of Regional institute of medical sciences,Imphal for a period of 2 years. 100 individuals were taken,out of these 50 were diabetics and 50 non diabetics.PCT was measured by focussing a narrow horizontally aligned beam of fixed dimensions at the inferior part of pupil to initiate rhythmic cycles of contraction and relaxation,and the cycle time was measured in milliseconds with a hand held stop watch.Mean PCT of diabetics was compared with non diabetics and its correlation with different variables such as age, diabetes duration,sex,blood sugar was done .Results-Mean PCT of diabetic patients was prolonged as compared to non diabetics and also there was prolongation of PCT with increasing age and diabetes duration.Conclusion-Type II diabetes is associated with prolonged PCT,and it gets more prolonged with the duration of diabetes.PCT can be used as a fast and reliable clinic test to assess the amount of autonomic neuropathy affecting pupil of a diabetic patient.*

Keywords: *Edge light pupil cycle time,PCT,type-II diabetes*

I. Introduction

Diabetic autonomic neuropathy can affect various parameters of pupil like pupil size in dark and bright light, pupil light reflex latency,variable response to mydriatic and miotic eye drops specially the ones with long standing diabetes and also other parameters dependent on resting pupillary size like contrast sensitivity and glare.In the background of newer expensive pupillary function assessment techniques PCT remains the most novel inexpensive technique so far.

II. Purpose Of Study

1. To compare the pupil cycle time of patients with type-II diabetes with healthy control subjects.
2. To find correlation between autonomic neuropathy due to diabetes with different variables like age, duration of diabetes and different grades of retinopathy.

III. Patient Selection

Inclusion criteria for cases.
1) Diagnosed type-2 diabetes mellitus patients.
2) Patients who could understand verbal commands.

Inclusion criteria for controls.

1)Patient not suffering from Diabetes Mellitus.(Confirmed by blood sugar test)
2) Patients who could understand verbal commands.

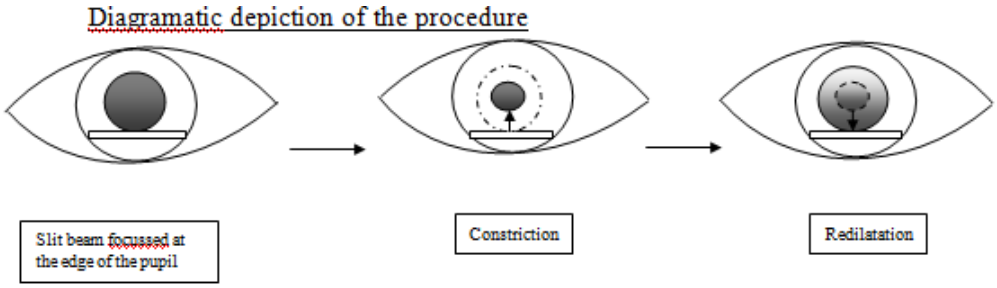
Exclusion criteria for cases and controls.
1) BCVA less than 0.1 according to Snellen eye chart
2) Cataract greater than NO2 OR NC2 by LOCS 3 classification
3) Patients with systemic disease that could affect pupil
4) Patients with a history of medication that might affect autonomic function
5) Patients with corneal opacity or dystrophy, uveitis, rubeosisiridis, glaucoma, vitreous haemorrhage, previous ocular trauma or ocular surgery
6) Pseudophakic or aphakic patients
7) Patients who had been on full session pan retinal photocoagulation (PRP)
8) Type -1 diabetes mellitus patients.
9) Gestational diabetes mellitus.

IV. Methods-

The diagnosis of type -II diabetes mellitus was established on the basis of clinical features, history and blood sugar (fasting and post-prandial).Examination included visual acuity recording, pupillary light reflex, IOP, slit lamp and cranial nerve examination to rule out other causes of neuropathy affecting pupil.Informed and written consent was obtained from the patient and PCT was measured by a method derived from that of Miller and Thompson but with some minor variations.

V. Pupil Cycle Time Measurement Procedure

The total number of patients were be divided into two groups, diabetic and non-diabetic.PCT was measured in both the groups by the same observer.The subject sits at the slit lamp in a dimly lit room and is instructed to look towards the light source of the slit-lamp. A narrow horizontally aligned slit of light ,which is 8mm long and 0.7mm wide is focussed accurately on the lower part of the iris(i .e inferior limbus) in a plane perpendicular to it. The beam of light is slowly elevated until it just impinges on the pupil .In normal subjects this invariably initiates the cycle of constriction and dilatation described in the introduction .The pupillary oscillations are easily observed through the low -power binocular microscope of the slit lamp and the time for 100 cycles of dilatation and constriction can be measured with a hand-held stop-watch. Two runs of 30 and one of 40 cycles are timed. The mean PCT is then calculated by simple division.Then the PCT was compared with in the group as well as among the two groups.



VI. Results And Observations

1.Age distribution

The age of the patients ranged from 34 to 73 years. The largest number of patients 35 (35%) were in the age group of 40-49years and 50-59 years, followed by 21(21%) in age group of 60-69 years and 8% in age group 70- 79 years.The lowest 1% in age groupof 30-39 years.

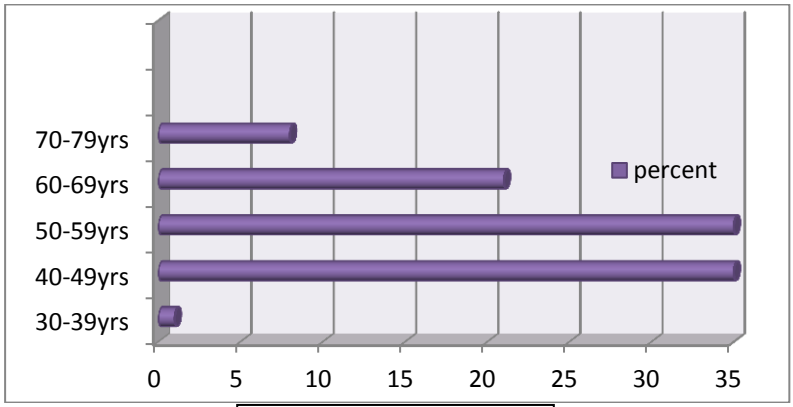


Fig 1 age distribution

2. Sex distribution

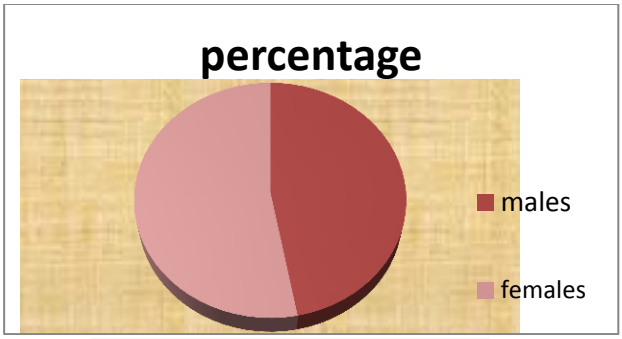


Figure 2 sex distribution

3.Type of diabetic retinopathy

Of the total 50 diabetic patients i.e 100 eyes.on examining fundus of 100 eyes,43%eyes were having normal fundus,26 % were having mild NPDR,14% were having moderate NPDR, 7%were having severe NPDR,5%were having very severe disease and remaining 5%were having PDR

4.Duration of diabetes

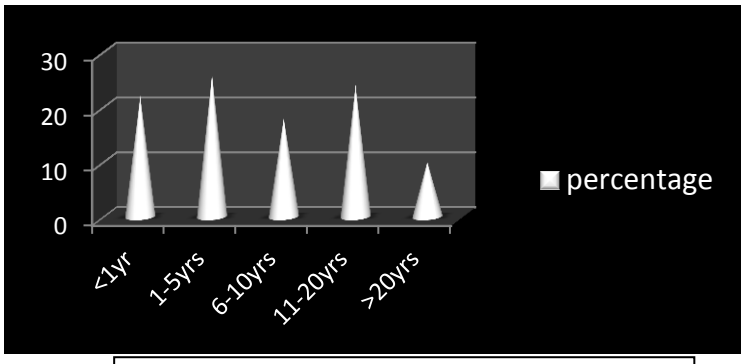


Figure 3 diabetes duration distribution

5.Correlation between Pupil cycle time (PCT) and age of the patient

In the present study there was a definite correlation present between PCT and age of the patient. This correlation of age can be elicited only in control group which was at the same time highly significant but could not be demonstrated in diabetic patients as diabetes itself affects PCT .

The scatter plot below(fig 4) shows increase in PCT(in milliseconds) with increase in age of the patient.

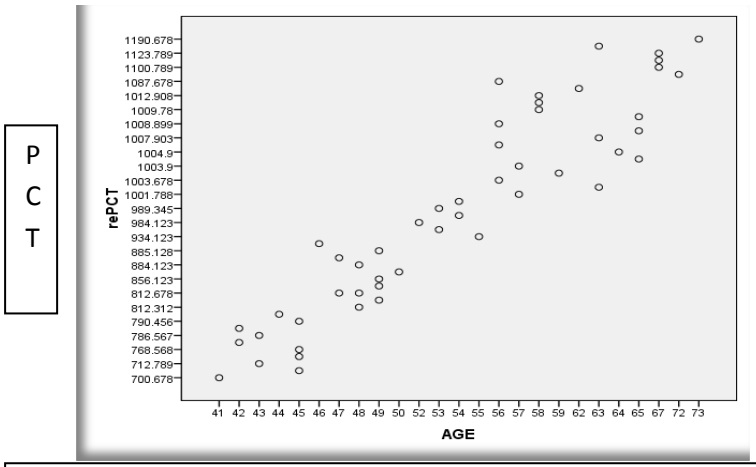


Figure 4 shows increase in PCT with increasing age

6.Correlation of Pupil cycle time (PCT) and duration of diabetes

On examining the PCT of diabetic cases there was an evident lengthening of PCT with increasing duration of diabetes. This correlation between PCT and duration of diabetes was statistically significant. Scatter plot below (fig 5)shows lengthening of PCT with increasing duration of diabetes.

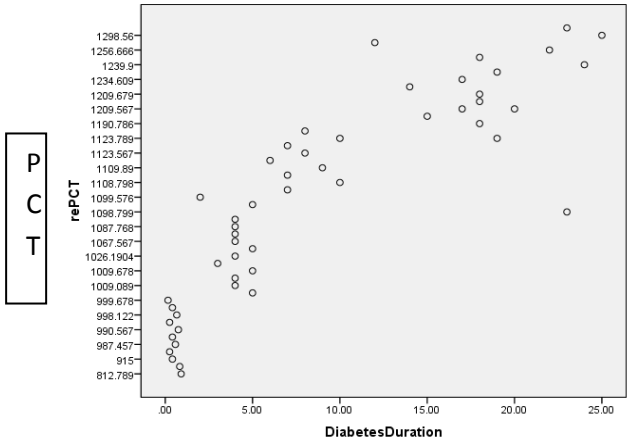


Figure 5 shows correlation of PCT and diabetesduration

7.Association between type of diabetic retinopathy and PCT

According to fundus examination of 50 diabetic patients.Total of 100 eyes were divided into three groups namely normal(group A), mild to moderate NPDR(Group B) and the last group C with severe NPDR to PDR.

Table 1

Type of retinopathy	Total number of eyes in the group	PCT<1101.24	PCT>1101.24
Group (A) Normal	43	67.4%	32.6%
Group(B) Mild to moderate NPDR	40	52.5%	47.5%
Group(C) Severe NPDR,Very severe disease**,** PDR	17	17.6%	82.4%
Total eyes examined	100		

Association of prolonged PCT with increasing grade ofretinopathy

As we can see from the above table that among the patients with mild to moderate diabetic retinopathy only 47.5% were found to have PCT value more than 1101.23ms but in the last group majority of the patients i.e 82.4% were found to have PCT more than 1101.23ms proving a strong association between grade of diabetic retinopathy and PCT. This association was found to be statistically significant with p value 0.002 taking significance level <0.05.

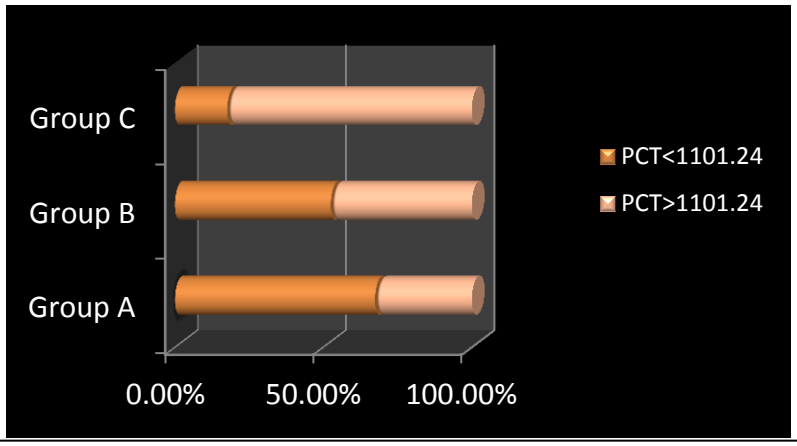


Figure 6 shows Association between type of diabetic retinopathy and PCT

8.**Comparison of mean PCT between cases and controls**

The mean PCT of 50 diabetic patients(i.e 100 eyes) was 1101.243 ms with SD ± 112.141ms whereas mean PCT of 50 control subjects(i.e 100 eyes) was 941.515 ms with SD ±124.362 ms. On applying independent student t test to the comparison between mean PCT of diabetic cases and controls,the p value came out to be 0.057,which was close to the margin of statistical significance.

Table 2

Serial Nmbr	N	Mean PCT	Std. Deviation	Std. Error Mean	P vaue
Cases	100	1.101243	112.141481	11.214148	0.057
controls	100	9.415152	124.362673	12.436267	

Mean PCT of diabetic casesand controls with their standard deviations

VII. Discussion

In the present study we have found a tendency towards a lengthening of the PCT in control group with age ranging from 41 to 73 years (Mean±SD=54.26yrs±8.5yrs).This is supported by other studies like R S Manor et al[1] (1981) which also showed that there was evident tendency for PCT to increase with age.On the other hand above findings were negated by Sood A K et al[2](1985) who did not find any significant correlation between age and PCT.

In the present study mean PCT of diabetic patients is 1101.243ms whereas mean PCT of controls is 941.51ms with SD of 112.14ms and 124.36ms respectively there was slight variation in reference PCT value for normal individuals according to other studies like R.S. Manor et al[1] (1981) studied the pupil cycle time (PCT) in 86 normal subjects aged from 10 to 79 years. The mean PCT in the age group of 50 to 79 years was 872±83 ms whereas mean PCT was 946±120ms in the group of 50 normal subjects studied by Martyn C N et al[3](1986) which is similar to our study.On the other hand Mean pupil cycle time(PCT) for children to middle age ranged from 818 to 958 milliseconds in a study done by MoodithayaS et al[4](2009).This increased value of mean PCT in our study can be explained by slightly increased distribution of normal subjects in elderly age group.

In our study PCT is prolonged in diabetics as compared to healthy normal subjects,pointing to pupillary autonomic neuropathy as the probable explanation for this result. Similar finding is cited by many other studies like S E Smith[5](1978) et al, Martyn C N et al[3](1986),Kim G C et al[6](1995).Martyn C N et al (1986) concluded PCT is prolonged in diabetics and correlates well with evidence of autonomic neuropathy obtained from testing of cardiovascular reflexes

VIII. Conclusion

Pupil cycle time is prolonged in diabetic patients and is found to be increasing with increasing duration of diabetes and increasing grade of retinopathy. The cause of prolongation might be due to pupillary autonomic neuropathy. Pupil cycle time is one of the most important diagnostic method of pupillary function in diabetic cases. It is very simple and an inexpensive tool to assess pupillary function in diabetic patients.

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