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Research Article

Refractive Errors in Type 2 Diabetic Patients

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Abstract

Purpose: A community-based study was conducted to identify the extent of prevalence of refractive errors among the type 2 diabetic population in Lucknow.

Methods: A total of 437 patients (> 40 years old) with type 2 diabetes were examined with a complete eye screening tests including objective auto refraction. Spherical equivalent refractions of both eyes were reported. Data collected include age, gender, general medical information and serum biochemistry.

Results: The mean refraction was −0.84 ± 2.59 D. Prevalence rates were determined for astigmatism (63.8%) hyperopia (1.4%) and myopia (0.2%%). 34.6% patients were emmatropic. Age is an important factor for all of the refractive errors. Correlation showed that every increase of one year of age and one percent of HbA1c is associated with 0.05 D (p = 0.003) and 0.14D (p = 0.04) shift in hyperopia, respectively.

Conclusions: This study provides epidemiological data on refractive errors in a North indian population in Lucknow, India. The Astigmatism prevalence is higher than the reported rates in the diabetic population compare to hyperopia and myopia. Second major finding was emmatropia.

Keywords: Refractive Errors; Type 2 Diabetes; Prevalence; Community-based Study

Introduction

Since the 19th century, it's been recognized that changes in blood sugar concentration can influence vision in patients with diabetes [1-3]. Optometrists are trained to think about the likelihood of undiagnosed diabetes if a patient complains of a bilateral, unexpected or rapid change of vision or prescription.

If diabetes is suspected, the attention care practitioner may postpone prescribing spectacles until the refractive error has stabilised, which generally occurs when the patient's diabetes is best controlled. Refractive changes related to diabetes will be both acute (transient) and chronic (sustained). However, relatively little is thought about the biochemical changes, which accompany these refractive events. Chronic refractive changes reported in diabetic patients include a rise in myopia [4-8]. These refractive changes tend to be of an occasional magnitude and present during adulthood. This study conducted a prospective study of 874 eyes of 437 diabetic patients who underwent glycemic control for severe hyperglycemia, in a shot to create an objective evaluation of refractive changes during treatment.

Methods

A hospital based cross sectional study was conducted at rural center of Era Lucknow Medical College and Hospital, Lucknow from January 2018- December 2019. Total 874 eyes of 437 patients were examined. All the patients with type II diabetes mellitus with clear optical media were included in the study. Eyes with corneal opacity, opaque media, pseudoaphakia, aphakia, history of prior surgery or patients with proliferative diabetic retinopathy, clinically significant macular edema were excluded. All the subjects underwent comprehensive eye examination consisting of subjective and objective and subjective examination, anterior and posterior eye examination. Visual acuity was determined using Snellen chart. Refractive error was defined according to spherical equivalent (SE) refraction which was calculated as the spherical diopters plus one half the cylendrical diopters. Myopia was difined as SE refraction ≤ -0.25 D. Hyperopia was defined as SE refraction ≥ -0.25D. Emmatropia was defined as SE refraction between -0.25D and +0.25 D. The level of metabolic control was evaluated by measuring glycosylated haemoglobin (HBA1c), fasting blood sugar (FBS) and post prandial blood sugar (PPBS). Subject who had participated in this study were well informed about the purpose of the study and confidentiality was maintained. Data from both eyes were reported and analyzed using SPSS 23.

Results

Among 437 subjects, 47.1% were female and 52.9% were male. The mean age of these subjects was 50.30 ± 5.83 years. Among 437 patients 72.5% were illiterate, 25.9% had primary level of education whereas 1.6% were graduate. The monocular uncorrected visual acuity (UCVA) was better than or equal to 6/18 in 69.1% (Table 1). Monocular best corrected visual acuity were better than 6/12 in each eyes (Table 2).

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	6/6	300	34.3	34.3	34.3
	6/9	42	4.8	4.8	39.1
	6/18	262	30	30	69.1
	6/24	112	12.8	12.8	81.9
	6/36	56	6.4	6.4	83.3
	6/60	102	6.4	6.4	100.0
	Total	874	100.0	100.0	

Table 1: Monocular UCVA.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	6/12.	60	6.9	6.9	6.9
	6/6.	608	69.6	69.6	76.4
	6/9.	206	23.6	23.6	100.0
	Total	874	100.0	100.0	

Table 2: Monocular BCVA.

Among 874 eyes, 558 (63.8%) were astigmatism, 302 (34.6%) were emmetropic, 12 (1.4%) were hypermetropic and 2 (0.2%) were myopic (Table 3 and Figure 1). The spherical equivalent were calculated for astigmatism eyes were -0.75 D to +2.75D (Table 4).

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Astigmatism	558	63.8	63.8	63.8
	Hypermetropia	12	1.4	1.4	65.2
	Myopia	2	.2	.2	65.4
	Emmetropia	302	34.6	34.6	100
	Total	874	100.0	100.0	

Table 3: Refractive Error.

Figure 1: Refractive status of eye.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-0.75	40	4.6	4.6	4.6
	-1.25	264	30.2	30.2	34.8
	-1.75	98	11.2	11.2	46.0
	-2.25	56	6.4	6.4	52.4
	-2.75	102	11.7	11.7	64.1
	+0.75	10	1.1	1.1	65.2
	+2.75	2	.2	.2	65.4
	0.00	302	34.6	34.6	100.0
	Total	874	100.0	100.0	

Table 4: Spherical equivalent.

Among 437 patients, maximum duration of having diabetes was 10 years. 11.4% patients were suffering with diabetes since 10 years. The minimum duration with diabetes was 1 years and in this category 20.1% patients were listed. The mean duration was 3.92 ± 2.628 years (Table 5). The mean Fasting Blood sugar (FBS) was 145.01 ± 66.13 mg/dl, Post Prandial Blood Sugar (PPBS) was 219 ± 92 mg/dl and HBA1C was 7.09 ± 1.06%. 127 (29.1%) had good glycemic control (Table 6).

Year		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	91	20.8	20.8	20.8
	10	50	11.4	11.4	32.3
	2	60	13.7	13.7	46.0
	3	50	11.4	11.4	57.4
	4	78	17.8	17.8	75.3
	5	108	24.7	24.7	100.0
	Total	437	100.0	100.0	

Table 5: Duration of Diabetes.

		Frequency	Hba1c	Percent
Valid	Good Controlled	127	5.6-7.8	29.1
	Fair Controlled	209	7.9-10.1	47.8
	Poor Controlled	101	>10.1	23.1
	Total	437		100.0

Table 6: Laboratory findings (n = 437 patients).

The majority 65.4% of the study patients eye had Diabetes Retinopathy while 34.6% of them had normal fundus. None of patients had proliferative diabetes retinopathy (Table 7). There were no statistical significance between myopia and hypermetropia with HBA1C ($p > 0.05$).

Diabetes Retinopathy		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	302	34.6	34.6	34.6
	Yes	572	65.4	65.4	100.0
	Total	874	100.0	100.0	

Table 7: Fundus examination findings (n = 874).

There was statistically significant correlation between astigmatism and HBA1C ($r = 0.401$ $p < 0.05$).

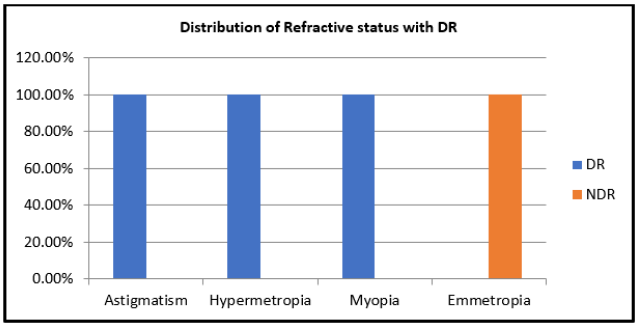

Figure 2: Distribution of refractive status with DR.

Discussion

Refractive error in the diabetes population is considered one of the main cause of visual impairment. Present hospital based cross sectional study was conducted at rural center of Era Lucknow Medical College and Hospital, Lucknow, found that prevalence of all types of refractive error in type 2 Diabetes was 65.4%. There is no similar study in our region to compare present study. However the study done in different countries are summarized in table 8.

Study	n	Population	Myopia (%)	Hyperopia (%)	Astigmatism (%)
Present study	874	Diabetic	0.2	1.4	63.8
Shristi., *et al*. [10]	170	Diabetic	25.2	45.0	29.8
Rani., *et al*. [11]	1080	Diabetic	21	39	47
Kinmen Study [12]	547	Diabetic	57	24	88
Mwale., *et al*. [13]	96	Diabetic	39.5	19	6.8

Table 8: Comparison of distribution of refractive errors between the present study and various published studies (Diabetes Population).

Hyperglycemia often goes unnoticed by diabetic patients, whereas there can be several undesirable symptoms related with acute hypoglycemia. A rapid decline in glucose concentration is related with sweating, trembling, anxiety, weakness, hunger, nausea and vomiting. However, prolonged hypoglycemia can include more severe symptoms like visual disturbances, restlessness, irritability, inability to concentrate, confusion and personality changes among others [13]. Thus diabetic patients should take immediate action to correct his/her hypoglycemic state (usually with an intake of glucose), and any associated refractive error shifts may be therefore avoided. Consequently, the response of the crystalline lens to untreated hyperglycemia could also be of more immediate concern

to the optometrist involved in carrying out eye examinations on diabetic patients. Thus, refractive error change will be influenced by the fluctuating glucose concentration. Therefore it seems appropriate to enquire about glucose concentration when carrying out eye examinations on diabetic patients. If glucose concentration is uncharacteristically high or low at the time of refraction, then it's going to be wise repeat the refraction before prescribing, furthermore as advising patients about the possible implications for diabetic retinopathy and other complications related to the disease. In hyperglycemia, glucose can accumulate within the lens causing a rise in curvature and a shift towards myopia [14]. However, hyperopic changes have also been shown to occur during hyperglycemia and this is often thought to result to a decrease in ratio within the lens. If the geometric effect dominates (swelling of the lens altering lens curvature), the refraction will shift towards myopia. If the refractive effect dominates, the refraction will shift towards hypermetropia. The underlying mechanism governing the relationship between plasma glucose concentration and refractive error isn't fully understood. there's no clear answer on whether the refractive changes seen are due simply to changes in refractive index of the cornea, aqueous humour or lens or whether swelling of the lens occurs causing changes to the its curvature, position or size. it's possible that both the ratio and surface curvature change, within which case either a myopic or hyperopic response may occur, counting on the individual's physiology. However, from a clinical point of view, fluctuating glucose concentration has an influence on short-term changes in refraction, and these changes could also be large enough to measure. within the majority of cases, people with diabetes appear to become more myopic as their glucose concentration increases. Where acute changes are reported within the literature, the latency of those changes appears to be short, being of the order of some minutes. This means that a hypo or hyperglycemic state could influence refractive findings during the eye-examination. When taking a diabetic patient's history, it seems appropriate to enquire about the foremost recent glucose concentration, or maybe suggest taking a finger stick test before the eye-examination. It should be borne in mind that (consistently) high glucose readings could induce transient myopia. During hypoglycemic treatment, some diabetic patients suffer from blurred vision. It's well known that changes of plasma glucose cause transient refractive error, but the biological basis of refractive changes within the eyes of diabetic patients has not yet been established and therefore the underlying mechanism is still unknown.

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