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REVIEW

The Impact of Refractive Errors Instability on the Life Quality of the Patients with Type 2 Diabetes

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Abstract

The present work aims to study the refractive error instability effects on life quality among type 2 diabetic patients and to understand the issues in people with refractive error. The cross-sectional study was conducted among patients of Ghazi Al-Hariri Hospital and Al-Diwaniyah Teaching Hospital from 1/11/2023 to 1/3/2024. A slit lamp, E chart, lensometer, OCT, trial case, and some tests were performed. One copy of the questionnaire was completed for each subject out of 100 diabetic patients. The present study included (48%) male and (52%) female who were diagnosed as type II diabetic patients. The results show that (89%) of patients had a refractive error in one or both eyes. Most of the participants (51%) had astigmatism followed by myopia (21%), and (17%) participants had hyperopia, most astigmatic patients have difficulty with doing things (54%), interfering with their life (50%), planning with friends (49%), feeling burdened (50%) and embarrassed (50%), and it shows diabetic patients with a longer duration of DM (97%) had a higher risk of ocular disease than patients with a shorter duration (45%). We conclude that evaluation of life quality is associated with refractive errors and that vision performances which depend upon diabetic patient's views increased in recent years, and measuring of life quality helped us greatly to reach an accurate comprehension of decision, need, treatment as well as elevation of the person's social level in life.

Keywords: Life quality, Refractive errors, Diabetic patients

1. Introduction

One of the commonest causes of visual impairments and an important reason for blindness in the world are the uncorrected refractive errors. Refractive errors (RE) may result from variation axial length variation concerning the eye's axial length (named axial myopia or hyperopia) or from the cornea's refractive power and the crystalline lenses concerning the eye's total refractive power (named refractive myopia or hyperopia) (Diel et al., April 14, 2020).

Refractive error in the diabetes population is considered one of the main causes of visual impairment. Information collection from patients on Diabetes mellitus is a typical element of history taking before clinical examination and refractive evaluation of ocular health. Questioning diabetic patients on their disease permits practitioners to evaluate the diabetic retinopathy risks and put all refractive complaints, that can result from bad-controlled blood sugar levels. The latter has a special importance when the patients report recent temporary vision fluctuation, which is one of the common complaints in diabetic patients (World Health Organization (WHO), 2016). Diabetes mellitus is a global chronic systemic disorder which primarily causes morbidities and mortalities. It was globally estimated in 2019 that 422 million adults were affected with diabetes (8.5%), and about 1.5 million patients died because of the disease (World Health Organization (WHO), 2016).

It was found that about 1/25 of adult patients in the USA were having type 2 diabetes. Type-2 DM is correlated with physical inactivity and obesity in addition to genetic features and processes associated with aging (Lee & Halter, 2017). The World Health Organization states that type-2 DM is now more commonly found in children, although it is usually detected in adults. Gestational diabetes indicates blood sugar

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higher than normal, but lower than DM levels during pregnancy. The WHO considers gestational diabetes as a risk factor for type-2 DM development in the future (World Health Organization (WHO), 2016).

It is common knowledge that blood glucose levels can affect refractive error. Acute alterations in blood sugar levels may shift refraction to either myopia or hyperopia (Kaštelan et al., 2018), despite, hyperopic shift is more commonly observed after intensive treatments (Li et al., 2010). In well-managed diabetes, as appears to be the case here, daily blood sugar level variations don't seem to affect refractions (Huntjens et al., 2012). Refractive changes in diabetes are typically due to changes in the thickness and curvature of the crystalline lens. Corneal curvature is usually unaffected and findings on corneal thickness differences between people with diabetes and age-matched controls are questionable (Huntjens & O'Donnell, 2006). Studies were conducted to show the effect of diabetes on ocular structure and function. Many impacts on the ocular surfaces were demonstrated, such as reduced tear film stabilities and secretions, as well as reduced corneal sensitivities (Misra et al., 2016). In diabetes, there will be an increase in central corneal thickness (Su et al., 2018). Dry eyes were shown to be commonly seen in type-2 diabetes and to be associated with life quality reduction (Yazdani-Ibn-Taz et al., 2019). Optical refractions, which are the accurate interpretations of visual information, rely upon the capacity of eyes to focus incoming light rays onto retina. It is essential to understand this process and how it is affected by normal variations or ocular diseases to the successful usage of all optical aids such as contact lens, corrective lens, intraocular lens, or using low vision aids. Development of retinopathy and other diabetic complications like elevated refractive errors are retarded by good diabetic controls (Yarbağ et al., 2015).

Sudden alterations in the lens refraction are caused by the diabetic state, particularly if DM is not controlled appropriately. The refractive power is altered by as much as 3 or 4 diopters of myopia or hyperopia, when blood sugar level is changed, resulting in blurred visions. These alterations do not happen on good glycemic control achievement. In healthy people, blood sugar levels are regulated within narrow limits, however such limits are disrupted in diabetic patients. It was recognized in the 19th century that the diabetic patients' visions are affected by the change in blood sugar levels (Yarbağ et al., 2015). Duke-Elder introduced in 1925 45 diabetic-induced refractive change cases and showed that the eye's refractive power varies with the changes in the blood content of and that such alterations might be myopic or hyperopic. Many researches revealed that after rapidly corrected hyperglycemia, patients with diabetes may exhibit acute hyperopic shifts. After rapid corrections, hyperopic shifts are observed, and it is argued that myopic shifts were initially found during hyperglycemia. Diabetes and its relationship with myopia has been and is still the most frequent historical teachings (Diel et al., April 14, 2020).

1.1. *Diabetes mellitus*

Diabetes is a metabolic disease of different causes described by chronic hyperglycemia with carbohydrate, fat, and protein metabolism disturbance, due to an insulin secretion defect, an insulin action defect, or both. The impact of diabetes involves long term damages, dysfunctions, and failures of different organs. Diabetic patients may be presented with specific symptoms like thirst, polyuria, vision blurrings, as well as weight losses. In most serious cases, there may be a development of ketoacidosis or non-ketonic hyperosmolar states leading to coma, stupor, and even death when not treated effectively. In DM development, many pathogenesis processes are included, causing destruction of the pancreatic beta cells with subsequent insulin deficiencies, or causing resistance to insulin actions (McCance et al., 1994).

1.2. *Symptom*

Diabetes symptoms may appear quickly. Diabetes symptoms may be mild and take several years to be observed.

Diabetes symptoms are:

- Feeling very thirsty
- Urination more frequent than usual
- Blurred visions.
- Feeling tired
- Unintentional weight loss (McCance et al., 1994)

1.3. *Classification*

There are three general types of DM:

- Type I DM, Insulin Dependent Diabetes Mellitus (IDDM).
- Type II DM, Non-Insulin Dependent Diabetes Mellitus (NIDDM).
- Gestational diabetes (Bornstein & Lawrence, 1951).

In the 1950s, it was demonstrated that diabetes is manifested in two main types different from each other by their exogenous insulin requirement: Insulin-dependent DM (type-1 DM, T1-DM) and non-insulin dependent DM (type-2 DM, T2-DM)

(Bornstein & Lawrence, 1951). After 2 decades, in the 1970s, it was discovered that there is a relationship between T1DM and autoimmunity, and there was a characterization of the first diabetes-associated autoantibodies and islet cell antibodies (ICAs) (MacCuish et al., 1974). The novel diabetes concept included gestational DM (GDM), latent autoimmune DM of adulthood (LADA), maturity onset diabetes of young (MODY), transient or persistent neonatal diabetes (TND and PND), and double DM or "1.5 diabetes", that indicates DM with clinical characteristics of both autoimmune and insulin resistance related T2D diabetes (Gilliam et al., 2005).

1.4. *Refractive errors*

Refractive errors (RE) are the most frequent ocular problems that affect all ages, specially school-age children, and are regarded as public health challenges (Pi1 et al., 2010).

1.5. *Types of refractive errors*

There are four most common refractive errors are:

- 1. Myopia: (near sightedness): clear visions close-up but blurring in the distances.
- 2. Hyperopia: (far sightedness): clear visions in the distances but blurring in close-up.
- 3. Astigmatisms: focusing disturbances caused by cornea.
- 4. Presbyopia: inability to focus close up as a result of aging (Chen et al., 2023).

1.5.1. *Myopia*

Myopia, also called near sightedness or short sightedness, is a very commonly disorder which usually begins in the childhood. Serious myopia conditions (pathologic myopias) are related to risks of other eye problems. All populations are affected by this disorder which reaches epidemic rates in East Asia, despite the prevalence variations between countries. Both genetic and environmental risk factors can cause myopia. Several control and management plans for myopia are found which can be used for treating of this disorder, however, understanding factors included in delaying the onset of myopia and reducing its progress will be essential to decrease the quick elevation in its prevalence in the world (Chowdhury & Shah, 2018).

1.5.2. *Hypermetropia*

Hypermetropia, also called far sightedness or long sightedness, a disorder in which parallel light rays that come from infinity are brought for focusing behind retina while accommodations are at rest. When there are hypermetropic refractive errors, patients will commonly suffer from headache since accommodations are stimulated. Headache occurs since, in the presence of hypermetropia, there will be a focus of the light behind retina, and if patients try to focus such image on retina by accommodation application. Hypermetropia is often related to posterior shortenings of eye balls. Other causes include corneal flattening, decreased refractive indices of the crystalline lenses as well as displacements of the crystalline lenses towards retina (Wang et al., 2018).

1.5.3. *Astigmatism*

It is one of the commonest refractive errors. Without effective corrections, severe astigmatism results in visual impairments, myopia and amblyopia during emmetropizations. Visual impairments because of astigmatism can also lead to inadequate educational performances and influence working potentials (Wolffsohn & Davies, 2019).

1.5.4. *Presbyopia*

More than a billion individuals in the world are affected by Presbyopia, which is a worldwide problem. In the developing countries, unmanaged presbyopia prevalence is 50% among people who are above 50 years of age, because of lack of accessibility to affordable treatment and lack of awareness, the prevalence of this disorder reaches 34% in developed countries. Presbyopia definitions are inconsistent and different; thus, we suggest a redefinition which says: "presbyopia occurs when the physiologically normal age-related reduction in the eye's focusing range reaches a point when optimally corrected for distance vision, that the clarity of vision at near is insufficient to satisfy an individual's requirements" (Naidoo et al., 2016).

1.6. *The prevalence of refractive errors*

Large numbers of people are affected by RE in the world regardless of ages, sexes and ethnic groups. A global estimation detected about 1.4 million blind children out of the 45 million individuals (Chen et al., 2023). Reports of the WHO indicated that refractive errors are the major causes of visual impairments and the 2nd reason for visual losses in the world because 43% of visual impairments are related to refractive error (Pascolini & Mariotti, 2012). There is a global increase in refraction error prevalence particularly among children because of electronic device misuse. In many Asian countries, it may reach 70–90% (Myopia, 2002), in England 50% (Garamandi et al., 2005), in North America 25% (Hashemi et al., 2004), and

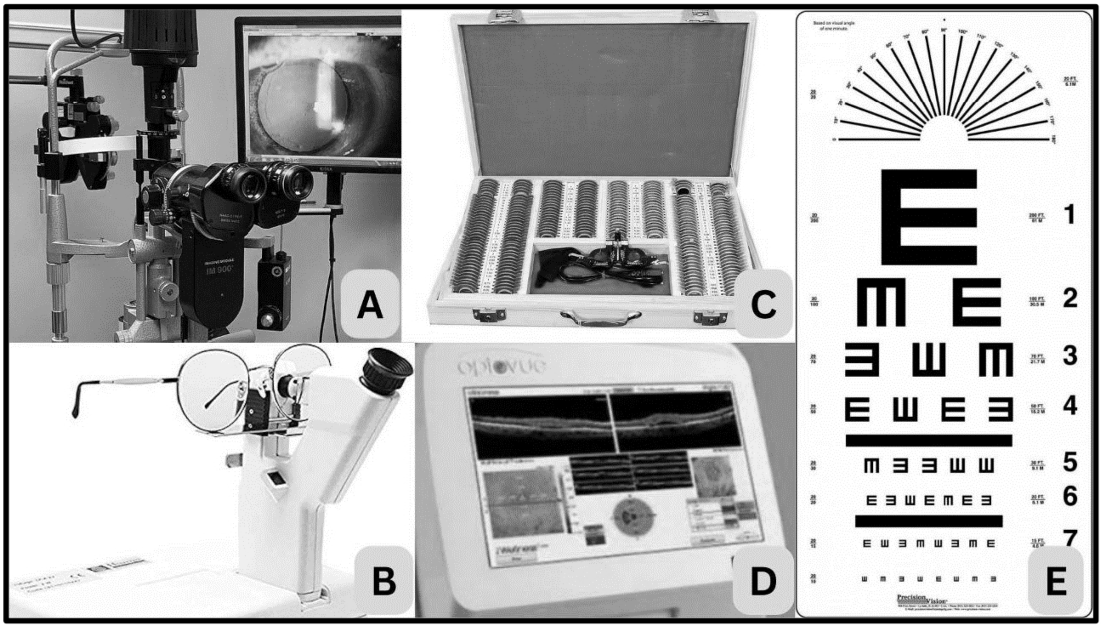

Fig. 1. A: slit lamp, B: lensometer, C: trail lenses case, D: OCT, E: E-chart.

Table 1. Distribution of study samples according to age groups and gender.

	Gender		
Age (years)	Male	Female	Total n (%)
<40	11 (48%)	12 (52%)	23 (100%)
40–50	11 (41%)	16 (59%)	27 (100%)
51–60	12 (40%)	18 (60%)	30 (100%)
>60	14 (70%)	6 (30%)	20 (100%)
Total	48 (48%)	52 (52%)	100 (100%)

21% in Iran (Sperdato et al., 1983). Both race and sex may affect the prevalence chance of refraction error in addition to nationality. The prevalence is higher among females compared to males and among white compared to black races (El-Bayoumy et al., 2007).

A survey performed in Egypt, 2007 on 5839 Egyptian children aged 7–15 years and revealed a 22.1% refractive error prevalence (visual acuity $\leq$ 6/12) (Shukrallah et al., 1997). In addition, a primary national survey made in Helwan area of Cairo revealed that visual disabilities were 34% of the documented disabilities (Elkot et al., 2015). In a study conducted in 2015 in Menoufia district, Egypt detected 24% refractive errors in primary school pupils, with 22% of them having myopia and only 2% having hypermetropia (Naidoo, 2012).

1.7. *Effects of refractive errors on quality of life*

Life quality of millions of individuals with different age sex and ethnicity is impaired by uncorrected refractive error which cause great problems to the patient's families and to the community due to manpower loss. Furthermore, for young people, the uncorrected refractive error may result in amblyopia with negative effects on their occupational, educational and athletic performances (World Health Organization (WHO), 2006). Refractive errors may result in problems to life quality of people associated with vision and cause difficulty to them to perform tasks relevant to it (Ziai et al., 2011). As a result, recently, there was an increase in the quality of life-related evaluation to refractive error and vision performance according to patient views. Life quality measurement could help us to reach to an appropriate comprehension of requirements, decision, treatment and elevation of the person's personal and social levels of life (Ziai et al., 2011).

Table 2. Distribution of different types of refractive error across age groups.

Age (years)	Emmetropic patients	Hyperopic patients	Myopic patients	Astigmatic patients	Total n (%)
<40	6 (27%)	1 (5%)	5 (23%)	10 (45%)	22 (100%)
40–50	3 (13%)	2 (8%)	3 (13%)	16 (66%)	24 (100%)
51–60	1 (3%)	6 (18%)	10 (30%)	16 (49%)	33 (100%)
>60	1 (5%)	8 (38%)	3 (14%)	9 (43%)	21 (100%)
Total	11 (11%)	17 (17%)	21 (21%)	51 (51%)	100 (100%)

Table 3. Distribution of patients with refractive errors based on personal characteristics & daily activity.

	Refractive errors			
	Yes		No	
Personal characteristics and their daily activities	No.	%	No.	%
Have difficulty in reading due to your eyesight?				
• All the time	42	42%	58	58%
• Most of the time	25	25%	75	75%
• Sometimes	14	14%	86	86%
• Never	19	19%	81	81%
Have difficulty in recognizing faces?				
• All the time	44	44%	56	56%
• Most of the time	22	22%	78	78%
• Sometimes	14	14%	86	86%
• Never	20	20%	80	80%
Have trouble threading a needle for sewing clothes due to your poor eyesight?				
• All the time	38	38%	62	62%
• Most of the time	25	25%	75	75%
• Sometimes	17	17%	83	83%
• Never	20	20%	80	80%
Have trouble preparing food due to your poor eyesight?				
• All the time	22	22%	78	78%
• Most of the time	24	24%	76	76%
• Sometimes	27	27%	73	73%
• Never	27	27%	73	73%
When walking can't see stones or walkways well?				
• All the time	19	19%	81	81%
• Most of the time	28	28%	72	72%
• Sometimes	27	27%	73	73%
• Never	26	26%	74	74%
Need help when walking around due to your eyesight?				
• All the time	15	15%	85	85%
• Most of the time	20	20%	80	80%
• Sometimes	23	23%	77	77%
• Never	42	42%	58	58%
Have difficulty carrying out your obligations due to your eyesight?				
• All the time	15	15%	85	85%
• Most of the time	22	22%	78	78%
• Sometimes	28	28%	72	72%
• Never	35	35%	65	65%
Have difficulty driving in glare conditions?				
• All the time	34	34%	66	66%
• Most of the time	19	19%	81	81%
• Sometimes	18	18%	82	82%
• Never	29	29%	71	71%
Can see the way to the bathroom when you wake up?				
• All the time	10	10%	90	90%
• Most of the time	15	15%	85	85%
• Sometimes	45	45%	55	55%
• Never	30	30%	70	70%

Table 4. Association between the measurement of best corrected visual acuity and the average of HbA1c.

	Measurement of visual acuity (n)%		
Result of HbA1c	Patients with BCV. A = 6/6, no. (%)	Patients with BCV. A < 6/6, no. (%)	Total No. (%)
4%–5.6%	22 (79%)	6 (21%)	28 (100%)
>5.6%	7 (10%)	65 (90%)	72 (100%)

Table 5. Association between type of treatment the diabetes and level of HbA1c.

	Type of treatment		
Level of HbA1c	With insulin n (%)	Without insulin n (%)	Total n (%)
4%–5.6%	8 (29%)	20 (71%)	28 (100%)
>5.6%	40 (56%)	32 (44%)	72 (100%)

2. Patients and methods

There are 100 patients total in this study, all of them have diabetes mellitus and are of both genders and ages, half were among patients of Ghazi Al-Hariri Hospital and the other half were among patients of Al-Diwaniyah Teaching Hospital. The study started from 1/11/2023 to 1/3/2024. A cross-sectional investigation was carried out in several Iraqi hospitals. Any patient who came to the previously mentioned hospitals and had a history of diabetes and was accepted to fill out the questionnaire and undergo the examination was included in the study. With a questionnaire, demographic data, including age, gender, and occupation, were collected from each patient. Patients were also asked about wearing glasses, headache, eye strain difficulty in focusing, reading, recognizing faces, walking or driving… etc., and ocular examination information. Data were analyzed using descriptive statistics to determine the frequency and relationship between variables. During a thorough ocular examination, various instruments and techniques may be employed such as the following: **A slit lamp** is used to find out if they have retinal detachment, bleeding, or cataract, **OCT** tests of some patients have been checked, **E-chart** is used to examine the visual acuity of both patient's eyes, **Trial lenses case** is a case that contains a set of lenses that are used by trial and error in order to correct refractive errors, **Lensometer** is used to verify the prescription of eyeglasses or spectacles Fig. 1. All these exams were done in the previously mentioned hospitals under the supervision of the ophthalmologist and optometrist.

3. Results and discussions

Uncorrected refractive errors remain public health problems among various populations. A diabetic patient with uncorrected refractive error has a significant effect on his quality of life and affect his capability for earning to persons, families and communities as well as impaired life quality (Resnikoff et al., 2004).

The patients in the present study included 48 males and 52 females who were diagnosed with type-2 diabetes. The mean age of the participants was 52 years (minimum: 3, maximum: 80) years, with the majority of them were females (12%, 6%) (see Table 1). In accordance with a previous survey, the prediabetes and diabetes prevalence among individuals aged (40–49) years was 40.3% and 11.1% respectively, whereas the prediabetes and diabetes prevalence among individuals aged (60–69) years elevated to 47.6% and 23.9% respectively (Wang et al., 2021). Age progression is a main risk factor for prediabetes and diabetes (Junker et al., 2021).

Table 6. Association between the result of HbA1c and effects with ocular diseases.

	Percentage of patients affected with ocular diseases		
Result of HbA1c	Affected No. (%)	Non-affected No. (%)	Total No. (%)
4%–5.6%	9 (32%)	19 (67%)	28 (100%)
>5.6%	69 (95%)	3 (4%)	72 (100%)

Table 7. Association between the result of HbA1c and level of education.

	Level of education of the patients					
Result of HbA1c	Elementary No. (%)	Secondary No. (%)	College No. (%)	Postgraduate No. (%)	Simple education No. (%)	Total No. (%)
4%–5.6%	4 (8%)	5 (10%)	7 (14%)	3 (6%)	28 (59%)	47 (100%)
>5.6%	6 (11%)	13 (24%)	17 (32%)	8 (15%)	9 (16%)	53 (100%)

Table 8. Association between the duration of affected with diabetes and having ocular diseases.

	Affection with ocular diseases		
Duration of affected with diabetes	Affected No. (%)	Non-affected No. (%)	Total No. (%)
1–2 years	5 (45%)	6 (55%)	11 (100%)
2–4 years	7 (47%)	8 (53%)	15 (100%)
4–6 years	11 (73%)	4 (27%)	15 (100%)
>6 years	57 (97%)	2 (3%)	59 (100%)

Table 9. Association between the duration of affected with diabetes and level of best corrected visual acuity.

	Level of visual acuity		
Duration of affected with diabetes	BCV.A = 6/6 No. (%)	BCV.A < 6/6 No. (%)	Total No. (%)
1–2 years	8 (73%)	3 (27%)	11 (100%)
2–4 years	9 (60%)	6 (40%)	15 (100%)
4–6 years	4 (27%)	11 (73%)	15 (100%)
>6 years	8 (14%)	51 (86%)	59 (100%)

Most of the participants (51%) had astigmatism followed by myopia (21%), and (17%) participants had hyperopia (see Table 2). Naidoo et al., 2004 indicated in 2010 the responsibility of uncorrected refractive errors for visual impairments among 101.2 million persons and blindness among 6.8 million persons around the world (Pascolini & Mariotti, 2012).

Patients with refractive errors have difficulties due to their eyesight in reading, recognizing faces, sewing, preparing food, walking, fulfilling obligations, driving, and walking in the dark (42%, 44%, 38%, 22%, 19%, 15%, 34%, 10%, respectively), the result shows we have fewer prefrail and frail persons and more non frail persons (see Table 3). In the group of uncorrected refractive errors, a low rate of persons were non frail (53% vs. 67%) and high rate were pre-frail & frail (40% vs. 29%, 7% vs. 4%) respectively compared to persons without uncorrected refractive errors (Lee et al., 2020 Jun).

(90%) patients with a higher level of HbA1c > 5.6% have BCV. A < 6/6 (see Table 4). In 1982 in the UK, Oxford it was shown by a population-based study conducted that there was a visual impairment in (28%) of (188) type-2 diabetic persons (Cohen *et al.*, 1991). Nevertheless, older ages are significantly associated with decreased VA in both populations. During each year of increased age, the risks of one step reduction in VA increased by 13% and 15.6% for diabetic and non-diabetic individuals, respectively (Pascolini & Mariotti, 2012).

This study shows patients who use insulin have a higher level of HbA1c (56%) than those who don't use insulin (44%) (see Table 5). Data from this Fine-Asia study showed great variable glycemic control degrees in people suffering from type-2 diabetes, based on countries of residency. In the country cohort study, it was noted that the highest patient percentage reaching target HbA1c level of <7.0% at the end of the study (71.5%) was reported in Chinese population (Pascolini & Mariotti, 2012).

Most of the participants (95%) with a higher level of HbA1c are affected by ocular diseases (see Table 6). Hypoglycemia (high blood glucose levels) is usually not observed by patients with diabetes, while there can be many unwanted symptoms related to acute hypoglycemia. Prolonged hypoglycemia may involve more serious symptoms such as visual disturbance, restlessness, irritabilities, incapability to concentrate, ocular diseases etc (NDIC 2003) (Marrero & Parchman, 2003).

In the current study, it was noticed that most of the patients had a simple educational level (59%,

Table 10. Association between the level of best corrected visual acuity and the quality of life for the sample of the study.

	Level of visual acuity		
Quality of life	Patients with BCV.A = 6/6 No. (%)	Patients with BCV.A < 6/6 No. (%)	Total No. (%)
Happiness feeling	20 (47%)	23 (53%)	43 (100%)
Performing things easily	20 (47%)	23 (53%)	43 (100%)
Feeling angry when performing things	2 (6%)	30 (94%)	32 (100%)
Feeling burdened due to your eyesight	7 (17%)	35 (83%)	42 (100%)
Feeling embarrassed due to your eyesight	7 (18%)	32 (82%)	39 (100%)
Poor eyesight interferes with your life	7 (18%)	32 (82%)	39 (100%)
Planning with friends	28 (41%)	40 (59%)	68 (100%)

Table 11. Association between the types of refractive error and the quality of life for the sample of the study.

Quality of life	Types of refractive error				
	Emmetropic patients No. (%)	Hyperopic patients No. (%)	Myopic patients No. (%)	Astigmatic patients No. (%)	Total No. (%)
Feeling happiness	9 (28%)	4 (13%)	2 (6%)	17 (53%)	32 (100%)
Doing everything easily	9 (28%)	4 (13%)	2 (6%)	17 (53%)	32 (100%)
Feeling angry when doing things	0 (0%)	15 (23%)	15 (23%)	35 (54%)	65 (100%)
Feeling burdened due to your eyesight	0 (0%)	15 (21%)	20 (29%)	35 (50%)	70 (100%)
Feeling embarrassed due to your eyesight	0 (0%)	15 (21%)	20 (29%)	35 (50%)	70 (100%)
Poor eyesight interferes with your life	0 (0%)	15 (21%)	20 (29%)	35 (50%)	70 (100%)
Planning with friends	9 (15%)	12 (20%)	10 (16%)	30 (49%)	61 (100%)

Table 12. Association between those affected with Rheumatoid Arthritis and those having ocular diseases.

Affected with Rheumatoid Arthritis	Affected with ocular diseases		
	Affected No. (%)	Non-affected No. (%)	Total No. (%)
Yes	46 (92%)	4 (8%)	50 (100%)
No	32 (64%)	18 (36%)	50 (100%)

16%) (see Table 7), and this was in agreement with the prospective longitudinal study performed by Sturock *et al.*, (2015) who studied vision-related life qualities among people with low visions (Sturrock et al., 2015).

Diabetic patients with a longer duration of DM (97%) had a higher risk of ocular disease than patients with a shorter duration (45%) (see Table 8). Some studies provided data on eye disorders in general populations when diabetic individuals were involved in the sampling frames (Saw et al., 2007).

Most of the diabetic patients (86%) have BCVA < 6/6 with a longer duration of DM > 6 years (see Table 9). In T1 Diabetic patients, there was -0.28 diopter changes in refractions within 10 years. Patients with longer diabetes durations with proliferative retinopathies had more probability to show hyperopic shift in refractions (Klein et al., 2011).

Patients with BCV.A < 6/6 have difficulty with doing things (94%), interfering with their life (82%), planning with friends (59%), feeling burdened (83%) and embarrassed (82%) (see Table 10). Most study patients showed that were limited to perform day to day activity e.g. feeling angry following doing a thing, planning a friend, achieving and doing everything**.** It agreed with Kandel *et al.*, 2017 who found presence of activity limitation (difficulty in performing day to day activity). Thus, refractive errors had great effect on peoples' lives. This may be the main cause of individuals who seek refractive corrections (Kandel et al., 2017).

Overall, 80% of diabetic patients with errors of refraction had a bad feeling about their quality of life, most astigmatic patients have difficulty with doing things (54%), interfering with their life (50%), planning with friends (49%), feeling burdened (50%) and embarrassed (50%) (see Table 11). It agreed with the study by Pak pour *et al.*, 2013) conducted in Iran, which studied the association between life quality and psychometric properties (Pakpour et al., 2013).

Patients with RA have a higher percentage of (92%) affected with ocular disease (see Table 12). Extra-articular manifestations in RA are present in 10–20% of patients which are more frequent in diabetes patients (Sahatçiu-Meka et al., 2010).

4. Conclusions

The quality-of-life score of patients with refractive errors is lower than that of persons without them. Interestingly, compared to other refractive errors, the negative effect on the quality-of-life score is much more noticeable in astigmatic individuals. Therefore, as it may enhance patients' quality of life, it is highly advised that astigmatic cases should be managed.

5. Recommendations

- Screening more patients than that used in the current study.
- Raising awareness of correcting refractive errors with suitable glasses will significantly reduce the magnitude of visual impairment in subjects with diabetes mellitus.
- Importance of early detection of visual impairment among T2DM to prevent morbidity and mortality.
- Regular comprehensive eye examination includes visual acuity charts, slit lamp, and OCT... etc. under the supervision of the ophthalmologist and optometrist.

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