

Clinical features of diabetic patients with dry eye disease in a community in Maceio: a cross-sectional study

Características clínicas de pacientes diabéticos com olho seco em uma comunidade de Maceió: estudo transversal

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ABSTRACT

Objective: This study was carried out in order to assess the epidemiological profile of symptomatic dry eye in diabetic patients. **Methods:** Two hundred and twenty-one diabetic patients were evaluated using a specific questionnaire about other diseases and drugs. Of these, 58 who classified as having moderate to severe dry eye were included. **Results:** In this study, 58 of the 221 diabetic patients had moderate to severe dry eye (26.2%). Of the 58 patients, dry eye was more prevalent at age 61.46 ± 14.18 years for men, and 61.09 ± 10.64 for women ($p < 0.005$). Dry eye was more common in women (75.9%) ($p = 0.456$). Of the 58 patients, 15 (25.9%) had at least one ocular disease. The most common was diabetic retinopathy (13 of 15 patients, 86.7%, 95% CI 69.46-103.87). A total of 19 patients used eye drops (32.8%); and most (14 of the 19 individuals, 73.7%) used lubricants (95% CI 53.88-93.48). Hypertension was the most prevalent associated comorbidity (56.9%) and the most commonly used medications were hypoglycemic agents (98%, 95% CI 94.00 – 101.92) and angiotensin converting enzyme inhibitors (53.1%, 95% CI 53.06 39.09 – 67.04). **Conclusion:** Further epidemiologic studies need to be done to establish a real etiologic relationship between diabetes and dry eye, and its correlation to other risk factors. In spite of these limitations, we have strong evidence of this relationship, and in clinical practice, examination for dry eye should be part of the assessment of diabetic disease.

Keywords: Dry eye/epidemiology; Diabetes mellitus/complications, critical patient, epidemiology, profile

RESUMO

Objetivo: O estudo foi realizado para descrever o perfil epidemiológico de pacientes diabéticos com olho seco sintomático. **Métodos:** Duzentos e vinte e um pacientes diabéticos foram avaliados por meio de questionário específico sobre outras doenças e medicamentos. Destes, 58 foram diagnosticados com olho seco moderado a severo e foram incluídos no estudo. **Resultados:** Neste estudo, 58 dos 221 pacientes diabéticos tinham olho seco moderado a severo (26,2%). Dos 58 pacientes, o olho seco, foi mais prevalente na faixa etária de $61,46 \pm 14,18$ anos para os homens e $61,09 \pm 10,64$ para as mulheres ($p < 0,005$). O olho seco foi mais comum em mulheres (75,86%) ($p = 0,456$). Dos 58 pacientes, 15 (25,9%) tinham pelo menos uma doença ocular. A mais comum foi a retinopatia diabética (13 de 15 pacientes, 86,7%, IC de 95% 69,46-103,87). Um total de 19 pacientes utilizavam colírios (3,8%); lubrificantes foram os mais usados (14 dos 19 indivíduos, 73,7%, (IC de 95%, 53,88-93,48). A hipertensão foi a doença mais prevalente associada (56,9%) e os medicamentos mais utilizados foram hipoglicemiantes orais (98%, IC 95% 94,00 – 10,92) e inibidores da enzima conversoras da angiotensina (53,1%, IC 95%, 53,06 39,09 – 67,04). **Conclusão:** Novos estudos epidemiológicos devem ser feitos para avaliar a real relação etiológica entre olho seco e diabetes e sua correlação com outros fatores de risco. Apesar das limitações, temos fortes evidências da relação entre olho seco e diabetes. Na prática clínica, o exame de olho seco deve ser parte da avaliação dos diabéticos.

Descritores: Olho seco/epidemiologia; Diabetes Mellitus/complicações

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INTRODUCTION

Diabetes Mellitus is a disease which is often followed by microvascular complications, such as nephropathy, neuropathy and retinopathy.⁽¹⁾ It is one of the main causes of blindness in people aged between 20 and 74.⁽²⁾

Dry eye disease (DES) is a major tear deficiency disorder which causes discomfort, visual disturbances and tear film instability with potential damage to the ocular surface.⁽³⁾ Dry eye can lead to vision deficit, scarring, cornea perforation, and secondary bacterial infection. It is important, then, to make early diagnoses of this disease.⁽⁴⁾

Reported prevalence of dry eye is diverse, with questionnaire-based surveys documenting rates ranging from 14.4% to 33% of the population.⁽⁵⁻⁸⁾ Studies which also involve tests of tear function for determination of dry eye, including Schirmer's test, tear break up time and others, have generally found lower prevalence rates.⁽⁸⁾ However, there have been discrepancies in the prevalence reported in the literature, due to a lack of consensus about appropriate diagnostic criteria and differences in the parameters and research methodology applied.⁽⁹⁾

Generally, diabetic patients have classic symptoms of dry eye, including irritation, foreign body sensation, burning, itchiness, pain or redness; they usually also have alterations in Schirmer test.⁽¹⁰⁾ Autonomic dysfunction may be the mechanism responsible for dry eye in the diabetic patient, and aldose reductase, the first enzyme of the sorbitol pathway, may also be involved.⁽¹¹⁾ Jin et al., showed that diabetic type 2 patients have a greater tendency to develop tear dysfunction.⁽¹²⁾ Few studies reported prevalence of dry eye in diabetic patients in the literature, and these rates ranged from between 14.4% to 54.3%^(7; 12-17). There is a lack of studies that describes the profile of the diabetic patient with moderate to severe dry eye. We aimed, therefore, to describe the epidemiologic profile of diabetic patients with moderate to severe dry eye, and to try to evaluate the relationship with possible associated risk factors.

METHODS

In a prospective observational study, from December, 2014 to April 2015, we evaluated 221 diabetic patients that were referred to the ophthalmologic department of the Dr. Alberto Antunes University Hospital or to the João Paulo II Reference Unit, both located in the city of Maceió, Alagoas State, Brazil. These patients were diagnosed previously with diabetes according to ADA criteria.⁽²⁾

Informed consent was obtained from all subjects and the research had the approval of the institutional board and ethics committee (Universidade Federal de Alagoas) and the National Committee of Ethics and Research (CONEP: 30435114.6.0000.5013)

Clinical data of all patients included sex, age groups (35 to 45.8, 45.8 to 56.6, 56.6 to 67.4, 67.4 to 78.2, 78.2 to 89 years old), race (black, white, yellow, brown or indigenous), duration of diabetes, fasting glycaemia, history of other diseases, like heart disease, recent stroke history (less than 6 months), psychiatric or neurologic diseases or dementia, rheumatic diseases, thyroid diseases, intestinal inflammatory disease, asthma or other allergic diseases, report of dry mouth or another mucosae, ocular diseases (cataract, glaucoma, macular degeneration, keratopathies, diabetic

retinopathy), previous ocular surgeries, photocoagulation report, use of eye drops, use of medication and cigarette smoking. The data was obtained by reviewing the medical records and through direct interview of the patient.

Dry eye patients were defined in our study as individuals that had at least one of the classical symptoms plus one or more alterations in the objective tests analyzed. They were evaluated for common symptoms of dry eye ocular discomfort⁽¹⁷⁾ including: soreness, gritty sensation, itchiness, redness, blurred vision that improves with blinking and excessive tearing. The frequency of these symptoms was graded as: never (graded as "1"), rarely (at least once in 3-4 months, graded as "2"), often (at least once a week, graded as "3") or all the time (graded as "4"). These patients were then submitted to a Schirmer test. The Schirmer test was graded as follows: "1", when it was 15mm or more in 5 minutes; "2", when it was less than 15mm; "3" when it was less than 5mm; and "4" when it was less than 2mm. Those that reported one or more of the symptoms graded as "3" or "4" and had a Schirmer test inferior to 15mm in 5 minutes⁽¹⁷⁾ were defined as having moderate to severe dry eye, based on criteria proposed by the American Academy of Ophthalmology⁽¹⁸⁾ and DEWS.⁽¹⁹⁾

Corrected visual acuity was assessed in all patients. Structures of the eye were assessed with slit lamp biomicroscopy examination. Retinal status was evaluated by indirect ophthalmoscopy after dilation using a tropicamide 1% drop.

We also evaluated conjunctival injection, corneal staining with fluorescein, conjunctival staining, corneal or tear signs, meibomius glands and lid alterations and break-up time (BUT), as follows:⁽¹⁹⁾

Conjunctival injection: graded from "1" to "4", indicating absent, mild, moderate and severe signs respectively;

Conjunctival staining: graded from "1" to "4", indicating none to mild, variable, moderate to marked, and marked respectively;

Corneal staining: graded from "1" to "4", indicating none to mild in grade "1", variable in grade "2", marked central in grade "3", and severe punctate erosions in grade "4";

Corneal or tear signs: graduated from "1" to "4" which means none to mild, mild debris and reduced meniscus, mucus clumping plus filamentary keratitis and the final stage with all these signals in addition to ulceration.

Meibomius glands and lid alterations were also graded from "1" to "4", indicating variable to present in first two stages, frequent in third stage, and with possible symblepharon and trichiasis in the last grade.

BUT classification also followed DEWS, and means normal (1), equal or less than 10 seconds (2), equal or less than 5 seconds (3) and equal or less than 2 seconds (4), respectively.⁽¹⁹⁾

Statistical methods

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS version 20.0, Chicago IL). Significance was considered to be $P < 0.05$. Results were given with their 95% CIs. Data were presented as mean \pm SD. Data normal distribution and verified by the Kolmogorov-Smirnov test. Age-group analysis was performed using the Kruskal-Wallis test. Gender group analysis was performed using the Mann Whitney U test.

Grading of symptoms and signs, based on DEWS criteria, and American Academy of Ophthalmology,^(18,19) were presented as median and amplitude.

RESULTS

In this study, 221 diabetic patients were assessed. There were 58 patients (26.2%) included in the study, which filled the criteria of moderate and severe dry eye. There were 14 men (24.1%) and 44 women (75.9%). The mean age of subjects was 61.46 ± 14.18 years for men, and 61.09 ± 10.64 for women. The distribution in age groups was statistically significant (p<0.005).

Ethnic group distribution in dry eye patients was: 19% brown, 58.6% white and 22.4% black. No patients self-declared yellow or indigenous ethnicities.

Most patients were in the 56.6 - 67.4 year-old group (43.1%), while the 35-45.8 year-old group had the fewest (6.9%).

Male patients (n=14) with dry eye disease had a mean duration of diabetes of 11.22 ± 9.705 years whereas this was 9.86 ± 8.155 years in women subjects (n=44). The highest mean of diabetes duration time was found in the 67.4-78.2 year-old group (13.29 ± 9.57). Mean duration of diabetes was not statistically significant among sex and age (p= 0.718 and p=0.711 respectively). Highest fasting glycaemia (226 ± 66.12) was verified in the 35-45.8 year old group, and was highest in men (216.62 ± 139.462). However, it was not statistically significant among age and sex (p= 0.277 and p=0.456 respectively), (Tables 1 and 2).

Ocular discomfort was defined as having one or more traditional dry eye symptoms, and all patients were graded in grade “3” or “4”. The Schirmer test was evaluated with median and amplitude and ranged from “2” to “4”, the latter found in the

Table 1

Patient profile by age group and gender - mean variables (SD)

Age Groups	No.	Age	Glycaemia	Diabetes Duration Yrs.	VA OD	VA OS
35 – 45.8	4	39.50 (4.20)	226 (66.12)	12 (9.90) 0.6 (0.4)	0.87 (0.231)	
45.8 – 56.6	14	51.43 (2.74)	223.36 (130.47)	9.80 (7.54)	0.49 (0.306)	0.51 (0.271)
56.6 – 67.4	25	61.40 (2.99)	166.80 (78.78)	8.35 (7.32)	0.56 (0.334)	0.51 (0.346)
67.4 – 78.2	9	70.78 (3.03)	192.11 (121.85)	13.29 (9.57)	0.32 (0.200)	0.37 (0.305)
78.2 - 89	6	83.00 (3.46)	140.83 (65.93)	12.00 (12.47)	0.35 (0.392)	0.48 (0.386)
p value		<0.001	0.277	0.711	0.256	0.266
Gender	No.	Age	Glycaemia	Diabetes Duration Yrs.	VA OD	VA OS
Male	14	61.46 (14,18)	216.62 (139.462)	11.22 (9.705)	0.44 (0.323)	0.5 (0.365)
Female	44	61.09 (10,64)	176.87 (85.426)	9.86 (8.155)	0.50 (0.326)	0.51 (0.320)
p value		0.55	0.456	0.718	0.567	0.992

Table 2

Patient profile by age group and gender; clinical signs

Median variables and amplitude

Age Groups	O.D.F.	Conj. Staining	Corneal Staining	Tear Meniscus	M.G.A.	BUT	Schirmer
35 – 45.8	3 (3-3)	1 (1 - 2)	1 (1-1)	1.5 (1 - 2)	1 (1 - 1)	2 (2 - 2)	2 (2 - 3)
45.8 – 56.6	3 (3-3)	1 (1 - 2)	1 (1-2)	2 (1 - 3)	1 (1 - 2)	2 (2 - 2)	3 (2 - 3)
56.6 – 67.4	3 (3-3)	1 (1 - 3)	1 (1-3)	2 (1 - 3)	1 (1 - 2)	2 (1 - 3)	2,5 (2 - 4)
67.4 – 78.2	3 (3-4)	1 (1 - 2)	1 (1-3)	2 (1 - 2)	1 (1 - 2)	2 (2 - 2)	2 (2 - 3)
78.2 - 89	3 (3-4)	2 (1 - 3)	1 (1-3)	2 (2 - 3)	2 (1 - 2)	2 (1 - 3)	2 (2 - 3)
p value	0.711	0.226	0.942	0.185	0.053	0.835	0.393
Gender	O.D.F.	Conj. Staining	Corneal Staining	Tear Meniscus	M.G.A.	BUT	Schirmer
Male	3 (3-4)	1 (1 - 2)	1 (1 - 2)	2 (1 - 2)	1 (1 - 2)	2 (2 - 3)	2 (2 - 3)
Female	3 (3-4)	1 (1 - 3)	1 (1 - 3)	2 (1 - 3)	1 (1 - 2)	2 (1 - 3)	2 (2 - 4)
p value	0.345	0.873	0.754	0.917	0.797	0.596	0.236

O.D.F.: Ocular Discomfort Frequency - 1: Absent 2: Mild 3: Moderate 4: Intense
 Conj. Staining: Conjunctival Staining - 1: Absent 2: Mild 3: Moderate 4: Intense
 Corneal Staining - 1: Absent 2: Mild 3: Moderate 4: Intense
 Tear Meniscus - 1: normal 2: mildly reduced 3: moderate 4: severe
 M.G.A.: Meibomius Gland Alterations 1: Absent 2: Mild 3: Moderate 4: Intense
 BUT: Break-up time - 1: Variable 2: <10s 3: <5s 4: immediate
 Schirmer: 1: Variable 2: < 15mm 3: < 5mm 4: <2mm

56.6-67.4 age group; there was no statistical significant difference between men and women (p=0.236). Results from other parameters, including conjunctival injection, corneal staining with fluorescein, conjunctival staining with fluorescein, reduced tear meniscus, meibomius gland alterations, break-up time (BUT) and visual acuity, and comparing them for age and sex, showed no statistical significance (Tables 1 and 2).

Of the 58 patients, 15 (25.9%) had at least one ocular disease. The most common was diabetic retinopathy (DR) (13 of 15 patients, 86.7%, 95% CI 69.46-103.87), the least common was macular degeneration (1 of 15 patients: 6.7% 95% CI -5.96-19.29). Previous ocular surgery was present in 28 of the 58 patients (48.27%).

Non-proliferative diabetic retinopathy was present in 10 patients (17.2% of the 58 selected individuals) and the other three had a proliferative form of the condition; two of these three had been submitted to photocoagulation.

A total of 19 patients used eye drops (32.8%); most used lubricants of various types (14 of the 19 individual, (73.7%; 95% CI 53.88-93.48) and 8 (42.1%; 95% CI 19.90-64.32) of them used ocular hypotensors for glaucoma (Table 3).

Table 3

Associated ocular conditions
Ocular Diseases (N=15)

	N	%	95% CI
Cataract	5	33.3	9.5 – 57.2
Glaucoma	10	66.7	42.9 – 90.5
ARMD	1	6.7	-6.0 – 19.3
Diabetic retinopathy	13	86.7	69.5 – 103.9
Use of eye drops (N=19)			
Use of glaucoma eye drops	8	42.1	19.9 – 64.3
Use of lubricant eye drops	14	73.7	53.9 – 93.5

Associated comorbidities and use of medication were also followed (Tables 4 and 5).

Table 4

Associated systemic comorbidities
(N=58)

		N	%	95% CI
Smoking	Yes	2	3.4	-1.2 – 8.1
	No	56	96.6	91.9 – 101.2
Thyroid disease	Yes	6	10.3	2.5 – 18.2
	No	52	89.7	81.8 – 97.5
Rheumatic disease	Yes	9	15.5	6.2 – 24.8
	No	49	84.5	75.1 – 93.8
Amputation	Yes	2	3.4	-1.2 – 8.1
	No	56	96.6	91.9 – 101.2
Psychiatric / Dementia	Yes	1	1.7	-1.6 – 5.1
	No	57	98.3	94.9 – 101.6
Dialysis	Yes	3	5.2	-0.5 – 10.9
	No	55	94.8	89.1 – 100.5
Stroke	Yes	3	5.2	-0.5 – 10.9
	No	55	94.8	89.1 – 100.5
Allergies / Bronchitis	Yes	3	5.2	-0.5 – 10.9
	No	55	94.8	89.1 – 100.5
Arterial hypertension	Yes	33	57	44.1 – 69.6
	No	25	43.1	30.4 – 55.8

Table 5

Use of oral medication
(N=49)

	N	%	95% CI
Hypoglycemic agents	48	98	94 – 101.9
Insulin	17	34.7	21.4 – 48
Diuretics	19	38.8	25.1 – 52.4
Calcium channel blockers	8	16.3	6 – 26.7
ACE Inhibitor	26	53.1	39.1 – 67
Lipid lowering agent	7	14.3	4.5 – 24.1
ASA	7	14.3	4.5 – 24.1
Beta blocker	8	16.3	6 – 26.7
Benzodiazepine	11	22.4	10.8 – 34.1
Antidepressants	8	16.3	6 – 26.7
Steroids	2	4.1	-1.5 – 9.6
Proton pump inhibitors	5	10.2	1.7 – 18.7
Digitalis	1	2	-1.9 – 6
Thyroxine	3	6.12	-0.6 – 12.8

*ASA: acetylsalicylic acid, *ACE: angiotensin-converting-enzyme

DISCUSSION

Several previous studies have investigated the relationship between DM and dry eye. Although some found an increased risk (7,15), others found neither a significant decrease in aqueous tear flow nor impaired TFBUT among those treated with insulin (10). Kaiserman (20) verified that DM increases dry eye and its severity. Seifart et al. found a 70% rate of dry eye in type 2 diabetes (13). Sendecka et al. reported that the most important conditions associated with dry eye were diabetes and hypertension. (14) Jain et al. presented 80 diabetic patients in a group of 400 patients with dry eye. (16) The cause of this correlation may be autonomic neuropathy and damage to microvasculature of the lacrimal gland, as well as sensorial corneal neuropathy. (11)

We used a questionnaire to assess the classic symptoms of dry eye, (18,19) selecting those graded “3” and “4” and associated to the Schirmer test inferior to 15mm in 5 minutes. Some studies report that Schirmer and BUT decreased in diabetic dry eye (10,13), in contrast to other authors that found that Schirmer, BUT and rose bengal staining have low sensitivity and underestimate dry eye disease when compared with a self-reported questionnaire about symptoms (8,15). Symptoms can be regarded as very important, due to the lack of correspondence between them and all these tests in diagnosing dry eye (21) Clinicians in practice also rely heavily on the evaluation of symptoms for dry eye diagnosis (21,22).

The frequency of moderate to severe dry eye in our study was 26.2% (58 patients). We did not evaluate prevalence of mild dry eye because our priority was frequent symptomatic dry eye, and mild cases usually have episodic symptoms or none at all. (19) There are few studies of prevalence of dry eye in diabetic patients, and it ranges from between 14.4% (7) to 54.3% (17). We did not find any other study that used only moderate to severe dry eye syndrome specifically in diabetes. But we know that prevalence of dry eye in the general population also presents a variation with environmental conditions, such as sunshine exposition, which increases this rate, and a high humidity ambient, that reduces it (23).

In this study we found that 24.4% were men and 75.86% were women, but it was not statistically significant. Some authors^(14,15,20,21) found that dry eye incidence increases in women; one of the explanations is the low rate of protector hormones like androgens. Other studies in diabetics show that diabetes keratoconjunctivitis sicca has no sex predilection.^(17,20) One hypothesis for this is that some of the anatomical and physiological modifications of the meibomian gland during aging have been linked to androgen deficiency, concurring with androgenic control of sebaceous glands in the skin⁽²⁴⁾. Therefore, this predilection is not so important with aging, because both men and women have a lower androgen pool when older.

Our research presented a mean age of moderate to severe dry eye of 61.46 ± 14.18 in men and 61.09 ± 10.64 in women, and these distributions of age groups was statistically significant. Kaiserman et al. found higher prevalence of dry eye with age in diabetics⁽²⁰⁾, while Liu et al. found that diabetes and increased age were important risk factors to dry eye in a systematic review.⁽²⁵⁾ However, Manaviat et al.⁽¹⁷⁾ did not find higher age to be a risk factor in diabetics with dry eye. We believe that it seems to be plausible that the dysfunction of lachrymal and meibomius glands with androgen insufficiency and other disjunctions that occur with age can contribute to an increase in dry eye disease in older people, irrespective of whether they are diabetic or not.

In our study we found a higher incidence of white people; others, however, showed no association with ethnic groups.⁽²¹⁾ The 2010 census reported that 50.7% of the Brazilian population is black or brown, with the largest proportion of this group located in the Northeast region⁽²⁶⁾. However, Cavalli-Sforza reports that all ethnic classification is “difficult, imperfect and arbitrary”,⁽²⁷⁾ and we can attribute this to the fact that its definition ranges from one time to another and according to the reason for it to be evaluated.

Time from diagnosis of diabetes and fasting glycaemia was evaluated in our study, and was not found to be statistically significant by sex or age; in the most prevalent age-group with dry eye (56.6-67.4 year old), we did not have the longest time of diabetes, nor the highest glycaemia. However, some studies report that diabetic keratoconjunctivitis sicca is more often found in diabetics with poorer glycemic control, and that dry eye syndrome occurs more often in the hyperglycemia phase, due to the high extracellular fluid osmolarity that disturbs tear production.^(13, 20, 28, 29)

We also analyzed comorbidities and use of medication in these patients. The most prevalent was hypertension (56.9%), and 84.48% used at least one medication. The most commonly used medication was oral hypoglycemic agents (98%) followed by angiotensin converting enzyme inhibitors (56.0%). It is controversial that some comorbidities can be a risk factor to dry eye syndrome. Schaumberg found that patients with hypertension and using drugs to treat hypertension and antidepressants had a higher prevalence of dry eye⁽²¹⁾. Moss, in 2000, found that allergies, hypertension and use of antihistamines and diuretics were an important risk factor to dry eye.⁽⁷⁾ However, the same author in 2004 did not find any relation between a lot of comorbidities with dry eye, like arterial hypertension, cardiovascular disease, thyroid disease, smoking, stroke, allergies or use of antidepressants; diuretics and antihistamines were shown to be relevant risk factors; use of angiotensin converting enzyme inhibitor might be a protection factor⁽¹⁵⁾.

Ocular disease was present in 48.7% of respondents. The most common was diabetic retinopathy (DR) (19%). This evidence is related to other research that shows a greater incidence

of DR in these patients.⁽²⁰⁾ Previous lens surgery was present in 48.3% of patients; Moss reported no evidence of a relationship with other ocular diseases such as cataract, lens surgery or maculopathy with dry eye syndrome,⁽⁷⁾ although other studies show that lens surgery can cause dry eye symptoms.⁽³⁰⁾

Eye drops were used by 19 of the 58 patients, and 14 of these used lubricants (24%). Kaiserman verified that 20.6% of diabetics with dry eye used lubricants, which is a similar rate,⁽²⁰⁾ and shows that some patients have been previously diagnosed with dry eye.

Limitations of our research were that it was mainly a descriptive study, which impairs statistical measurements, and that diabetic patient had other comorbidities that could be an independent risk factor to dry eye, although this is controversial.⁽¹⁵⁾

CONCLUSION

A better consensus in dry eye diagnosis should be reached, due to the poor correspondence between symptoms and objective tests for dry eye disease. There is a lack of epidemiological profile studies about diabetic symptomatic dry eye. Further research needs to be done to establish a real etiologic relationship between diabetes and dry eye, and its correlation to other risk factors. In spite of these limitations, we have strong evidence of this relationship, and in clinical practice, examination for dry eye should be part of the assessment of diabetic disease.

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