RESEARCH ARTICLE

Frequency and impact of individual symptoms on quality of life in dry eye disease in patients presenting to a tertiary care hospital

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Abstract

Objective: To assess the frequency of symptoms and impact on quality of life in individuals with dry eye disease.

Methods: The cross-sectional, study was conducted from December 2018 to June 2019 at the outpatient clinic of the Department of Ophthalmology, Pakistan Institute of Medical Sciences, Islamabad, Pakistan, and comprised dry eye disease patients aged at least 13 years with ocular burning sensation, lacrimation, grittiness, photophobia, redness or itching. Tear Film Breakup time <10 sec and / or positive ocular surface staining >5 corneal spots, >9 conjunctival spots, lid margin staining ≥ 2mm in length were used to diagnose the disease. Data was collected using the Dry Eye Quality of Life Score questionnaire. Data was analysed using SPSS 25.

Results: of the 191 patients, 135(71%) were females and 56(29%) were males. The overall mean age was 39.8±16.6 years. Itching 155(81.2%), watering 151(79.1%) and burning 124(64.9%) were the most frequent symptoms, with watering (p<0.001) and photophobia (p=0.012) significantly impacting quality of life.

Conclusions: The most common symptoms among patients of dry eye disease affecting their quality of life were itching, watering, burning, photophobia and low mood.

Keywords: Quality of life in dry eye disease, Dry eye disease, Lacrimation, Photophobia, Quality of life.

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Introduction

Dry eye disease (DED) is a chronic multifactorial disorder characterised by loss of homeostasis of the tear film, accompanied by symptoms of ocular discomfort and / or visual disturbance.[1] DED prevalence ranges 5-30%, depending on the population subset studied, lifestyle and geographical differences, the diagnostic criteria used, and the cut-off values employed; with some researchers claiming the prevalence to be considerably higher.[2,3] People with DED make up a substantial portion of patients presenting to ophthalmic clinics, and with the increasing use of video display terminals, worsening environmental triggers and prolonged life expectancies, the prevalence of DED is only expected to rise.

Despite the heavy disease burden, DED does not receive the deserved attention of ophthalmic practitioners due to it being deemed as a collection of bothersome ocular symptoms rather than a disabling condition with significant impact on quality of life (QOL). However, several studies have shown the chronic symptoms of DED to adversely affect QOL, with negative impact on activities of daily living (ADLs), work productivity and overall sense of well-being. A clinic-based cross sectional study having a healthy youthful clinical sample found increasing DED severity to be related to worsening QOL scores measured by the Dry Eye Quality of Life Score (DEQS) questionnaire.[4] Buchholz et al. found health utility indices in severe dry eye to be similar to those reported for dialysis and severe angina.[5] Work productivity loss was demonstrated by Uchino M et al.[6] This adverse impact of DED on QOL has been reported to be related most significantly to its symptomatology with weak to no correlation reported with the type of dry eye, Tear Film Breakup Time (TFBUT) measurements, Schirmer test values, or Ocular Surface Staining (OSS) scores.[7] Qihua Le et al. found that people with both symptoms and signs of DED as well as those with symptoms but no signs scored worse on the National Eye Institute Visual Functioning Questionnaire (NEI-VFQ), demonstrating that the presence of DED symptoms, even without the presence of signs, had an adverse impact on vision-related QOL.[8]

Despite the reported negative association between dry eye symptomatology and QOL, no studies could be found assessing the impact of individual dry eye symptoms on QOL. The current study was planned to analyse the frequency of occurrence of dry eye symptoms in individuals with diagnosed DED, and the impact of each of these symptoms on QOL.

Patients and Methods

The cross-sectional, study was conducted from December

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2018 to June 2019 at the outpatient clinic of the Department of Ophthalmology, Pakistan Institute of Medical Sciences (PIMS), Islamabad, Pakistan. After approval from the institutional ethical review board, the sample size was calculated using the World Health Organisation (WHO) calculator[9] with 95% confidence interval, 5% absolute precision and DED prevalence 18.7%.[10] The sample was raised using consecutive non-probability sampling from among DED patients aged at least 13 years. A screening questionnaire was used that enquired about the presence of one or more of the following symptoms in either or both eyes: burning sensation in the eyes, watering, grittiness, redness, photophobia and itching. Those having any of these symptoms due to any cause other than DED, including but not limited to allergic or infective conjunctivitis, trichiasis, entropion, lid laxity, punctal occlusion and stenosis, nasolacrimal duct obstruction, chronic dacryocystitis or facial nerve palsy etc., were excluded.

After taking verbal informed consent, all the participants enrolled were subjected to objective clinical testing to establish the DED diagnosis via measurement of TFBUT followed by ocular surface staining (OSS) with an interval of 1-3 minutes. Measurements for all patients were carried out by a single designated consultant ophthalmologist. The DEQS questionnaire was then administered to the diagnosed participants by two trained interviewers in a uniform manner. The interviewers were blinded to the results obtained from diagnostic testing.

DED diagnosis was made when the participant was positive for either TFBUT or OSS, or both in at least one eye, in addition to having symptoms of dry eye[11] for at least three months. All participants who underwent diagnostic testing were symptomatic as they had passed initial screening for dry eye symptoms. The participants with symptoms but no signs in either eye were excluded.

TFBUT was determined by staining the lower forniceal conjunctiva with fluorescein impregnated strips (Optima-strips, Excellent Hi Care Pvt. Ltd, India), that had been wetted with a drop of normal saline, and shaking off excess fluid. The time interval from the last blink to the appearance of the first dark spot was measured in seconds using cobalt blue filter and a stopwatch. A mean of three readings was taken and value <10 seconds was taken as positive.[10]

OSS was assessed 1-3 minutes after TFBUT measurement for all participants, using cobalt blue filter at the slit lamp with the fluorescein dye already instilled for the TFBUT measurement. Results were considered positive if there were >5 corneal spots, >9 conjunctival spots, lid margin staining of $\geq$2mm in length or 25% of the eyelid margin width.[11]

The DEQS questionnaire is a validated, widely used, 15-item tool for the screening and diagnosis of DED.[12] It comprises two multi-item subscales: Bothersome Ocular Symptoms (BOSs) and Impact on Daily Life (IDL). Each question has a Frequency of Symptoms scale and a Degree of Disability scale with values ranging 0-4, with 0 indicating absence of symptoms / no disability, and 4 indicating maximal frequency / highest degree of disability. The mean summary score for disability (MSD) was calculated by multiplying the sum of the degree of disability scale score by 25 and dividing it by the total number of questions answered. The summary score thus ranges 0-100, with higher scores indicating poorer QOL. The summary score was further categorised into quartiles $\leq$24, 25-49, 50-74 and $\geq$75 for analysis. The DEQS also has an additional, subjective, six-point, overall QOL scale, ranging from extremely good to extremely bad.

The DEQS was translated into Urdu prior to administration. The final questionnaire contained both the English and Urdu scales together and was employed after determining its validity and reliability in a subset of 20 patients who were proficient in both English and Urdu (α=0.91).

Data was analysed using SPSS 25. Categorical variables were expressed as frequencies and percentages, while numerical variables were expressed as mean ± standard deviation (SD). Multivariate analysis of variance (MANOVA) was applied to assess the impact of individual symptoms from the screening questionnaire as well as each question from the DEQS on MSD. P<0.05 was taken as significant with 95% confidence interval (CI).

Results

Of the 209 patients enrolled, 18(%) were excluded, and the final sample had 191(%) patients. Of them, 135(71%) were females and 56(29%) were males. The overall mean age was 39.8±16.6 years. MSD, as measured by DEQS, was 59.73±14.84. Subjective QOL as a result of eye symptoms was rated as "bad" by 136(71.2%) patients.

The most frequently reported symptom was itching 155(81.2%), followed by watering 151(79.1%), burning 124(64.9%), photophobia 110(57.6%) and foreign body sensation 105(55%). Only 46(24.1%) participants reported dryness among their ocular complaints. All 191(100%) patients reported a combination of three or more symptoms. Watering of the eyes (p<0.001) and photophobia (p=0.012) were significantly related to MSD (Table-1).

Table-1: Impact of patient-reported symptoms on the summary score for disability as measured by the DEQS* (MANOVA)†.

Symptom	p-value ‡
Itching	0.289
Burning	0.073
Foreign Body Sensation	0.322
Dryness	0.224
Watering	0.001
Photophobia	0.013

*DEQS: Dry Eye Quality of Life Score
†MANOVA: Multivariate Analysis Of Variance
‡ p-value <0.05 taken as significant.

Table-2: Patient-reported frequency of symptoms as 'often' or 'always' according to frequency scale of DEQS*.

DEQS Reported Symptoms	N	Percentage
Grittiness	41	21.4
Dry eyes	24	12.6
Sore eyes	43	22.5
Tired eyes	65	34
Heavy eyelids	64	33.5
Red eyes	32	16.7
Difficulty in keeping my eyes open	50	26.2
Vision became blurry when engaging in activities requiring sustained visual attention	53	27.8
Light was too bright	66	34.5
Eye symptoms worsened when reading newspapers or books	37	19.4
Eye symptoms when watching television or using a mobile phone	38	19.9
Eye symptoms reduced my ability to concentrate	46	24.1
Eye symptoms interfered with work, housework or studying	50	26.2
Tended to avoid leaving the house due to eye symptoms	19	10
Felt down due to eye symptoms	84	44.1

*DEQS: Dry Eye Quality of Life Score.

For analysis of the frequency scale of DEQS, responses marked "often" and "always" were grouped together, and 84(44.1%) participants often/always felt down due to their eye symptoms, 66(34.5%) often/always felt that the light was too bright, 65(34%) experienced tired eyes most frequently and 64(33.5%) experienced heaviness of the eyelids (Table-2).

While examining which symptoms were most troublesome for the patients, responses to the DEQS degree scale of 'bothered me' and 'bothered me very much' were grouped together. Feeling down due to eye symptoms was bothersome for 93(48.8%) patients, while 88(46.1%) were most bothered by the light being too bright. Heaviness of eyelids was the most troublesome clinical feature in 85(44.5%) patients, tired eyes in 83(43.5%) and grittiness in the eyes in 81(42.4%) patients (Table-3).

Table-3: Patient-reported frequency of symptoms as 'bothered me' or 'bothered me very much' according to degree scale of DEQS*.

DEQS Reported Symptoms	N	Percentage
Grittiness	81	42.4
Dry eyes	41	21.5
Sore eyes	69	36.1
Tired eyes	83	43.5
Heavy eyelids	85	44.5
Red eyes	52	27.2
Difficulty in keeping my eyes open	65	33.1
Vision became blurry when engaging in activities requiring sustained visual attention	72	37.7
Light was too bright	88	46.1
Eye symptoms worsened when reading newspapers or books	60	33.4
Eye symptoms when watching television or using a mobile phone	59	30.9
Eye symptoms reduced my ability to concentrate	62	32.5
Eye symptoms interfered with work, housework or studying	72	37.7
Tended to avoid leaving the house due to eye symptoms	33	17.3
Felt down due to eye symptoms	97	48.8

*DEQS: Dry Eye Quality of Life Score.

Table-4: Impact of individual responses to degree scale questions on the summary score for disability as measured by the DEQS* (MANOVA)†.

Response As Per Degree Scale Of The DEQS	p-value ‡
Grittiness	0.045
Dry eyes	0.413
Sore eyes	0.200
Tired eyes	0.105
Heavy eyelids	0.001
Red eyes	0.724
Difficulty in keeping my eyes open	0.089
Vision became blurry when engaging in activities requiring sustained visual attention	0.668
Light was too bright	0.000
Eye symptoms worsened when reading newspapers or books	0.000
Eye symptoms when watching television or using a mobile phone	0.012
Eye symptoms reduced my ability to concentrate	0.000
Eye symptoms interfered with work, housework or studying	0.002
Tended to avoid leaving the house due to eye symptoms	0.566
Felt down due to eye symptoms	0.036

* DEQS: Dry Eye Quality of Life Score
† MANOVA: Multivariate Analysis Of Variance
‡ p-value <0.05 taken as significant.

Significant association was found between the presence of the following symptoms and increasing MSD scores: Feeling that the light was too bright (p< 0.001), worsening of symptoms when reading newspaper/books (p< 0.001), reduced ability to concentrate (p< 0.001), heaviness of eyelids (p=0.001), interference of symptoms with housework/studying (p=0.002), worsening of symptoms while watching television/using mobile phones (p=0.012), feeling down due to eye symptoms

(p=0.031) and grittiness in eyes (p=0.045) (Table-4).

Discussion

The impact of DED on QOL scores, as measured in the current study, was significant; with the subjective QOL measure being described as "bad" by 71.2% participants, reconfirming the negative impact of DED on QOL.

"Feeling down due to eye symptoms" was found to be the most frequently reported as well as one of the most bothersome symptoms as per DEQS analysis, lending further weight to the negative impact of dry eye symptomatology on QOL. The high frequency of low mood in subjects with DED may also suggest a link with depression. Multiple studies have found DED to be associated with depression and anxiety.[13,14] Several mechanisms may contribute to the association between DED and psychiatric symptoms. Dry eye symptoms cause hindrance in the performance of ADLs, such as reading, using mobile phones or computers, watching television and driving, which may induce or aggravate anxiety and depression. Conversely, development or aggravation of dry eye symptoms may be attributed to somatisation, or to sensitization to pain that occurs in depression.[15] The anti-cholinergic effects of anti-depressant medications also contribute to the development or aggravation of symptoms of DED.[16]

The finding of photophobia being the second most frequently reported and bothersome ocular symptom as per the DEQS questionnaire analysis is also interesting, as photophobia is linked to a number of neurological and psychiatric conditions, including depression and anxiety.[17] Additionally, heaviness of lids and tiredness of eyes, the next most commonly reported and bothersome complaints, may be a part of the generalised fatigue that is experienced by patients with depression.[18]

If depression and DED are indeed linked, treatment of depression could result in the improvement of dry eye symptoms. It is known that symptoms of a somatic disease can worsen when patients have co-morbid depression.[19] However, the confounding factor here is that anti-cholinergic effect of anti-depressant medication is known to worsen the symptoms of dry eye. Further implications of the association between DED and depression are that eye-care practitioners could be the first avenue of help sought by patients with undiagnosed depressive illness. This makes the symptomatology of dry eye an important part of screening not just for DED, but also for co-morbid mental health disorders.

Itching of the eyes, which was the most frequently reported complaint, was found to have no significant impact on QOL. Ocular itching associated with allergic conjunctivitis is known to have a detrimental effect on QOL,[20] however the impact of dry eye-related itching on QOL has not been previously evaluated. Itching of the eyes in DED is believed to be of neuropathic origin,[21] as opposed to the histamine-mediated pathways implicated in allergic conjunctivitis. Furthermore, spontaneous burning sensation experienced by DED subjects is also a neuropathic pain-related condition.[22] The presence or absence of these neuropathic pain-related symptoms may explain the poor relation between signs and symptoms of dry eye and the variability in individual response to dry eye medications. Neuro-modulation could thus have a definite role in the treatment of chronic ocular itch and burning associated with DED.[23]

The symptom of watering of eyes was found to have the greatest impact on QOL and was the second most commonly reported symptom, after itching. Multiple studies have shown watering of eyes to adversely affect QOL.[24,25] However, the symptoms of watering and itching are assessed neither in the DEQS nor in the Ocular Surface Disease Index (OSDI),[26] both of which are validated and widely used screening questionnaires. Another widely used screening questionnaire, the Standardised Patient Evaluation of Eye Dryness (SPEED),[26] also enquires about watering, but not itching. Larger studies are needed to determine whether watering and itching are indeed prominent ocular complaints in dry eye so that their assessment may be incorporated in dry eye questionnaires.

Foreign body sensation, or a sensation of grittiness in the eyes, although found to be frequently reported, scored less than the other symptoms experienced by dry eye patients. A study in France[27] used the OSDI to assess for the symptoms of light sensitivity, gritty sensation in the eyes, painful or sore eyes and blurred or poor vision, and it found grittiness to be of less frequent and less severe occurrence than light sensitivity and sore eyes, which is similar to the current study. Likewise, a study conducted in Singapore also found grittiness to be not as frequently reported as the other evaluated symptoms of dry eye.[28] In contrast, grittiness was the most commonly reported complaint in an Indian study.[29] However, both these studies used the McMonnies questionnaire which assesses only the symptoms of ocular soreness, dryness, scratchiness, grittiness and burning. The symptoms of itching, watering and photophobia, which were found to be more frequently reported than grittiness in the current study, were not assessed in the two studies.[28,29] Also, the current study found the ocular complaint of dryness to be the least frequently reported symptom, and it was

probably due to the vague nature of descriptor language that made the participants to select the more descriptive terminologies in the screening questionnaire.

The current study has a few limitations. It was carried out on people presenting to ophthalmic clinics who might already have had more severe symptomatology and, consequently, poorer QOL compared to those with undiagnosed DED in the general population. Co-morbidities were not assessed which could have influenced QOL parameters, though the DEQS assesses QOL specifically in relation to dry eye, thus nullifying the impact of co-morbid conditions. The symptom of blurring in relation to dry eye was not assessed due to it being a confounding factor bearing a strong clinical association with other ocular disorders. Allergic conjunctivitis and DED may co-exist which may have influenced the frequency of occurrence of symptomatology and its pathogenesis and impact on QOL in patients with both these disorders. The most reliable way of distinguishing between the two is measurement of tear film osmolarity which could not be conducted due to unavailability of the tool in Pakistan.

Clinicians should consider DED high in the differential diagnosis of patients complaining of itchiness and watering, and to consider the presence of watering and photophobia as indicators of poorer QOL in individual with diagnosed DED. Measures should be taken to address these complaints in particular in order to improve QOL and to monitor improvement with treatment. Incorporation of the assessment of watering and itching is also recommended for use in the screening questionnaires for the diagnosis of DED.

Conclusion

Itching, watering, burning, photophobia and low mood were found to be the most commonly reported symptoms, and watering and photophobia to be the most adversely affecting QOL in individuals with diagnosed DED.

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References

1. Craig JP, Nichols KK, Akpek EK, Caffery B, Dua HS, Joo CK, et al. TFOS DEWS II Definition and Classification Report. Ocul Surf 2017;15:276-83. doi: 10.1016/j.jtos.2017.05.008.
2. Stapleton F, Alves M, Bunya VY, Jalbert I, Lekhanont K, Malet F, et al. TFOS DEWS II Epidemiology Report. Ocul Surf 2017;15:334-65. doi: 10.1016/j.jtos.2017.05.003.
3. Courtin R, Pereira B, Naughton G, Chamoux A, Chiambaretta F, Lanhers C, et al. Prevalence of dry eye disease in visual display terminal workers: a systematic review and meta-analysis. BMJ Open 2016;6:e009675. doi: 10.1136/bmjopen-2015-009675.
4. Asiedu K, Dzasimatu SK, Kyei S. Impact of Dry Eye on Psychosomatic Symptoms and Quality of Life in a Healthy Youthful Clinical Sample. Eye Contact Lens 2018;44(Suppl 2):s404-9. doi: 10.1097/ICL.0000000000000550.
5. Buchholz P, Steeds CS, Stern LS, Wiederkehr DP, Doyle JJ, Katz LM, et al. Utility assessment to measure the impact of dry eye disease. Ocul Surf 2006;4:155-61. doi: 10.1016/s1542-0124(12)70043-5.
6. Uchino M, Uchino Y, Dogru M, Kawashima M, Yokoi N, Komuro A, et al. Dry eye disease and work productivity loss in visual display users: the Osaka study. Am J Ophthalmol 2014;157:294-300. doi: 10.1016/j.ajo.2013.10.014.
7. Barabino S, Labetoulle M, Rolando M, Messmer EM. Understanding Symptoms and Quality of Life in Patients with Dry Eye Syndrome. Ocul Surf 2016;14:365-76. doi: 10.1016/j.jtos.2016.04.005.
8. Ayub A, Akhtar FM, Saleem N, Ali MH, Ayub MH, Butt NH. Frequency and Risk Factors of Dry Eye Disease in Pakistani Population, A Hospital Based Stud. Pak J Ophthalmol 2017;33:196-203.
9. World Health Organization. STEPS Sample Size Calculator and Sampling Spreadsheet. [Online] 2020 [Cited 2021 March 02]. Available from URL: https://www.who.int/ncds/surveillance/steps/resources/sampling/en/.
10. Le Q, Zhou X, Ge L, Wu L, Hong J, Xu J. Impact of dry eye syndrome on vision-related quality of life in a non-clinic-based general population. BMC Ophthalmol 2012;12:22. doi: 10.1186/1471-2415-12-22.
11. Craig JP, Nelson JD, Azar DT, Belmonte C, Bron AJ, Chauhan SK, et al. TFOS DEWS II Report Executive Summary. Ocul Surf 2017;15:802-12. doi: 10.1016/j.jtos.2017.08.003.
12. Sakane Y, Yamaguchi M, Yokoi N, Uchino M, Dogru M, Oishi T, et al. Development and validation of the Dry Eye-Related Quality-of-Life Score questionnaire. JAMA Ophthalmol 2013;131:1331-8. doi: 10.1001/jamaophthalmol.2013.4503.
13. Labbé A, Wang YX, Jie Y, Baudouin C, Jonas JB, Xu L. Dry eye disease, dry eye symptoms and depression: the Beijing Eye Study. Br J Ophthalmol 2013;97:1399-403. doi: 10.1136/bjophthalmol-2013-303838.
14. Li M, Gong L, Sun X, Chapin WJ. Anxiety and depression in patients with dry eye syndrome. Curr Eye Res 2011;36:1-7. doi: 10.3109/02713683.2010.519850.
15. den Boeft M, Twisk JW, Terluin B, Penninx BW, van Marwijk HW, Numans ME, et al. The association between medically unexplained physical symptoms and health care use over two years and the influence of depressive and anxiety disorders and personality traits: a longitudinal study. BMC Health Serv Res 2016;16:100. doi: 10.1186/s12913-016-1332-7.
16. Wong J, Lan W, Ong LM, Tong L. Non-hormonal systemic medications and dry eye. Ocul Surf 2011;9:212-26. doi: 10.1016/s1542-0124(11)70034-9.
17. Digre KB, Brennan KC. Shedding light on photophobia. J Neuroophthalmol 2012;32:68-81. doi: 10.1097/WNO.0b013e3182474548.
18. Arnold LM. Understanding fatigue in major depressive disorder and other medical disorders. Psychosomatics 2008;49:185-90. doi: 10.1176/appi.psy.49.3.185.
19. Moussavi S, Chatterji S, Verdes E, Tandon A, Patel V, Ustun B. Depression, chronic diseases, and decrements in health: results from the World Health Surveys. Lancet 2007;370:851-8. doi: 10.1016/S0140-6736(07)61415-9.
20. Buchholz PM, Walt J, Lorenz D, Burk C, Lee J. Patient impact of

allergic conjunctivitis as measured by the Eye Allergy Patient Impact Questionnaire (EAPIQ). Invest Ophthalmol Vis Sci 2003;44:3735.
21. Andersen HH, Yosipovitch G, Galor A. Neuropathic symptoms of the ocular surface: dryness, pain, and itch. Curr Opin Allergy Clin Immunol 2017;17:373-81. doi: 10.1097/ACI.0000000000000389.
22. Kalangara JP, Galor A, Levitt RC, Felix ER, Alegret R, Sarantopoulos CD. Burning Eye Syndrome: Do Neuropathic Pain Mechanisms Underlie Chronic Dry Eye? Pain Med 2016;17:746-55. doi: 10.1093/pm/pnv070.
23. Galor A, Moein HR, Lee C, Rodriguez A, Felix ER, Sarantopoulos KD, et al. Neuropathic pain and dry eye. Ocul Surf 2018;16:31-44. doi: 10.1016/j.jtos.2017.10.001.
24. Shin JH, Kim YD, Woo KI. Impact of epiphora on vision-related quality of life. BMC Ophthalmol 2015;15:6. doi: 10.1186/1471-2415-15-6.
25. Sipkova Z, Vonica O, Olurin O, Obi EE, Pearson AR. Assessment of patient-reported outcome and quality of life improvement following surgery for epiphora. Eye (Lond) 2017;31:1664-71. doi: 10.1038/eye.2017.120.
26. Asiedu K, Kyei S, Mensah SN, Ocansey S, Abu LS, Kyere EA. Ocular Surface Disease Index (OSDI) Versus the Standard Patient Evaluation of Eye Dryness (SPEED): A Study of a Nonclinical Sample. Cornea 2016;35:175-80. doi: 10.1097/ICO.0000000000000712.
27. Malet F, Le Goff M, Colin J, Schweitzer C, Delyfer MN, Korobelnik JF, et al. Dry eye disease in French elderly subjects: the Alienor Study. Acta Ophthalmol 2014;92:e429-36. doi: 10.1111/aos.12174.
28. Tan LL, Morgan P, Cai ZQ, Straughan RA. Prevalence of and risk factors for symptomatic dry eye disease in Singapore. Clin Exp Optom 2015;98:45-53. doi: 10.1111/cxo.12210.
29. Gupta N, Prasad I, Jain R, D'Souza P. Estimating the prevalence of dry eye among Indian patients attending a tertiary ophthalmology clinic. Ann Trop Med Parasitol 2010;104:247-55. doi: 10.1179/136485910X12647085215859.