

Original Article

Assessment of visual function and Vision-related Quality of Life in female contact lens wearers with Dry Eye Syndrome



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Abstract

Purpose: To assess visual function and Vision-related Quality of Life (VRQOL) in female contact lens wearers with Dry Eye Syndrome in Riyadh city, Saudi Arabia.

Methods: This was a cross sectional study. Saudi Females subjects with and without DES (contact lens wearer [CLW] and Non-contact lens wearers [NCLW]) aged between 16 and 35 years were included in this study. Subjects were recruited from female campus at King Saud University (KSU), Riyadh, KSA. Measurements include corneal topography, visual acuity (VA), autorefraction, contrast sensitivity (CS), Schirmer's test and Tear breakup test (TBUT) were performed on all subjects. In addition, corneal thickness was measured using Pentacam HR to compare between the total corneal thickness (TCT) in DES and Non-DES groups. Contact Lens Impact on Quality of Life (CLIQ) Questionnaire was used to assess VRQOL. Visual functions and VRQOL were compared between groups (contact lens (CL) and NCLW) using SPSS program version 23 (SPSS Inc, Chicago, Illinois, USA).

Results: A total of 100 subjects with DES ($n = 44$ including 25 CLW and 19 NCLW), and non-DES ($n = 56$ including 17 CLW and 39 NCLW) were included in this study. The mean age of participants with DES was 21.39 years and was 20.96 years of participants Non-DES. There were no significant different in VA, CS, and TCT between subjects DES and Non-DES ($P > 0.05$), which indicates that dryness have no effect on the visual function and TCT. Contact lens wearers had higher score on convince, economic and psychological items than NCLW. Within CL group, subjects with DES had higher score on convince and psychological items. Similarly, within DES group, subjects who wore CL had higher score on convince and psychological items.

Conclusion: This study provides evidence that dryness may has no effect on visual function in both CLW and NCLW. Psychological and convenience domains of VRQOL were negatively affect in Saudi female patients with DES specially who wear CL.

Keywords: Dryness, Contact lens, Questionnaire, Vision-related Quality of Life

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Introduction

Dry Eye Syndrome (DES), also known as keratoconjunctivitis sicca (KCS), was defined as "a multifactorial disease of the tears and ocular surface that results in symptoms of discomfort, visual disturbance, and tear film instability with potential damage to the ocular surface, which is accompanied by

increased osmolarity of the tear film and inflammation of the ocular surface".¹ The condition is considered as a growing public health problem and one of the most frequent reasons for seeking eye care.² The prevalence of DES varies from <0.1 to 33% worldwide.^{3,4} This variation proportion is due to many factors including gender, age⁴ different regions,⁵ different definitions of dry eye and different population.³ For

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example, in the United State of America (USA), the prevalence of DES is greater in elder people aged over 80 years than young people aged under 60 years. In addition, the risk of dry eye was greater in female by approximately 50% than male.⁴

There are another factors that can lead to DES such as weather,⁶ refractive surgeries such as LASIK,⁷ wearing contact lens⁸ and poor hydration.⁹ For example, the weather in Riyadh, Kingdom Saudi Arabia (KSA) is usually hot and dry during the whole year¹⁰ which can increase the chance to DES. It found that wearing SCL especially among Caucasians female subjects caused moderate dryness.⁸

Vision has significant positive or negative impact on Quality of Life (QOL). The daily activities of an individual's life such as reading, using computer and driving depend on the Visual Functions (VF). These difference visual tasks in everyday life can be affected by Dry Eye Syndrome (DES), which caused by dysfunction of secretory glands such as lacrimal gland. This dysfunction can affect the secretion of tear film and may decrease contrast sensitivity (CS) and visual acuity (VA) of individuals.^{11,12} Symptoms of DES are typically worse towards the end of the day¹³ and can limit some activities such as using computer, reading,^{14,15} and watching Television, which therefore impact negatively on individuals' Vision-related Quality of Life (VRQOL). It was reported that DES affect individuals' social function, mental health, vision-related role difficulties, dependency, and driving.^{16,17}

Visual functions performance in patients with DES can be reduced compared with non-dry eye individuals, which can affect visual functions including general vision, ocular pain, short and long-distance vision activities. Previous studies found that reduction of VA after measuring and observing sustained eye opening, surface regularity index (SRI) and blink rates in DES patients.^{11,13} Previous study found negative impact of DES in patients VRQOL who were more likely to report problems with reading, carrying out professional work, using a computer, watching TV and driving.¹⁴ However, the effect of DES on daily visual tasks and VRQOL on Saudi population, specifically on females were not fully understood and needs more investigations. Therefore, the aim of this study was to assess visual function and Vision-related Quality of Life (VRQOL) in female contact lens wearers with Dry Eye Syndrome in Riyadh city, Saudi Arabia.

Methods

Subjects

A total of 100 female with DES and Non-DES (NDES) were included in this study. Subjects were females either staff and/or students who studied or worked at King Saud University (KSU), Riyadh, KSA. All subjects have the same working environment as they either working in offices and/or studying in the university. The age of the subjects was ranged from 19 to 29 years. Inclusion criteria were female subjects with DES and NDES, soft CLW and NCLW. Exclusion criteria were subjects with history of diabetic, thyroid diseases, autoimmune diseases, ocular surgery pregnant and breast feeding. In addition, patients with high astigmatism (>1.5D) or Keratoconus (KC) were excluded from this study. This is because other ocular manifestations that the patient may experience. For example, patients with diabetic mellitus

may have frequent changes in vision due to instability of the glucose level in the blood, which can affect nutrients of the retina and reduce vision.^{18,19} Pregnancy can also affect vision due to the change of the corneal curvature.¹⁹ Also, patient with keratoconus are usually complaining from shadows and halos due to the increase of steepening of the cornea and astigmatism.^{20,21} Therefore, since dryness is not the primary cause of the reduction in the vision for these patients, these subjects were excluded from this study.

The tenets of the Declaration of Helsinki were followed and the study was approved by the Human Research Ethics Committee of Collage of Applied Medical Sciences, King Saud University, Kingdom of Saudi Arabia (KSA). Informed consent was obtained from all subjects after the nature of the study had been fully explained.

Measurements

Measurements include corneal topography, visual acuity (VA), autorefraction, contrast sensitivity (CS), Schirmer's test and Tear breakup test (TBUT) were performed on all subjects. Tear quantity was evaluated by Schirmer's test and TBUT for dry eyes classification. Visual acuity test and CS test were performed in order investigate the correlation between visual functions and DES. In addition, corneal thickness was measured using Pentacam HR to compare between the total corneal thickness (TCT) in DES and NDES groups.

The Contact Lens Impact on Quality of Life (CLIQ) Questionnaire²² was used to assess VRQOL of all subjects. This questionnaire was developed by Pesudovs et al. and was valid and reliable for subjects with DES who (or not) wearing CL. The questionnaire contains 28-items items which cover aspects of VRQOL including psychological well-being, social well-being, functional vision, convenience, economic, cognitive issues and health concerns. Demographic information including age, major, wearing vision correction, type of contact lens and duration were also collected from subjects.

Scoring criteria

The 28-item CLIQ questionnaire originally contains five responses (none = score 1; little = score 2; moderate = score 3; extreme = score 4 and unable = score 5). Items from 1 to 20 contain only three scores include moderate, extreme and unable, which was based on the domains that was measured. For example, items from 1 to 20 measured functional vision, convenience, economic, cognitive issues and health concerns. These domains would only have scoring from 3 to 5. The responses in these domains were developed from score 3 to 5 rather than from 1 to 3 to obtain accurate statistical analyzing. Items number from 21 to 28 contain four response scores (little, moderate, extreme and unable).²² These items were designed to measure social well-being and psychological well-being domains. Based on the differences between scoring responses in both domains, the statistical analysis was performed separately for each domain.

Statistical analysis

Visual function and VRQOL were compared between subjects with DES and NDES using SPSS program version

23 (SPSS Inc, Chicago, Illinois, USA). In addition, Within CL wearer group, visual function and VRQOL were compared between subjects with DES and NDES. Confidence level was 99% and statistical power was >80%. Descriptive analysis included mean and standard deviation of age, VA, CS, TCT, Schirmer tests and TBUT and significance difference was <0.01. Pearson correlation analysis test was used to assess the relationship between dryness and visual functions (VA and CS) as well as between dryness and TCT. To classify the correlation from weak to strong, Cohen et al.²³ scale of correlation classification was followed in this study.

Results

Participants

A total of 100 subjects with DES and NDES were participated in this study. Approximately, about half (44%) of the participants had DES. There was no significant difference in age ($P > 0.05$) between DES and NDES subjects. The mean \pm SD age and visual measurement including VA, CS and TCT are shown in Table 1. There were no significant differences in VA, CS, and TCT between DES and NDES subjects ($P > 0.05$), which indicates that dryness may have no effect on the visual function and TCT.

Participants were classified into CLW and NCLW. Table 2 shows measurements including Schirmer test, TBUT, VA, CS and TCT of subgroups. Participants with DES had less than 5 mm wetting in 5 min in Schirmer test, which indicates presence of dryness.²⁴ The TBUT in DES participants showed a black spot in less than 10 s of the average of three measurements that were taken to confirm dryness.²⁵ Within dryness group, there were no significant difference ($p > 0.05$) in Schirmer test, TBUT, VA, CS and TCT between CLW and NCLW groups. Similarly, in NDES group, there were no significant difference ($p > 0.05$) in Schirmer test, TBUT, VA, CS and TCT between CLW and NCLW groups.

Correlation between visual functions and DES

The effect of DES on visual functions (i.e. VA and CT) was tested using Pearson correlation test. Within DES group, there were no correlation between Schirmer test and, CS ($r = 0.49$) and VA ($r = 0.001$) ($P > 0.05$) (Figs. 1 & 2). Similarly, in NDES group, there were weak correlation between Schirmer test, CS ($r = 0.67$) and VA ($r = 0.003$). However, this correlation was not statistically significant ($P > 0.05$). This indicates that DES may not effect visual functions.

Correlation between corneal thickness and DES

The effect of DES on corneal thickness was tested. In DES group, there was weak correlation between TCT and DES, however no statistical significant difference ($P > 0.05$) was found (Fig. 3). Within NDES group, there was a negative correlation between TCT and NDES group, which was statistically significant different ($P = 0.004$).

Assessment of VRQOL

The responses of both DES and NDES participants on the CLIQ Questionnaire were compared. The results show that the scores of all items of the CLIQ questionnaire were higher in DES group than NDES group. However, there were significant differences ($p < 0.05$) in three items (items no 21, 24, 25) of psychological well-being between DES and NDES groups (including CLW and NCLW) (Table 3).

Participants were also classified based on wearing CL. The results showed that there were significant differences ($P < 0.05$) in ten items between CLW and NCLW. Subjects who wore CL had higher score on items no 8, 9, 21–28 than subjects who did not wear CL. These items represent convince (items No. 8 & 9), economic (item No. 12), and psychological domains (items from 21 to 28). Within CL group, there were significant differences ($P < 0.05$) in nine items between DES and NDES. Subjects with DES had higher score in items 8, 9, 21–28 than subjects who did not have DES. Similarly, within

Table 1. Visual characteristics of DES and NDES participants (including CLW and NCLW).

	DES N = 44	NDES N = 56	T-Test	Sig.
Age (Mean \pm SD)	21.39 \pm 2.755	20.96 \pm 1.747	0.933	0.353
Visual acuity	0.00 \pm 0.000	0.01 \pm 0.023	1.764	0.081
Contrast sensitivity	2.24 \pm .007	2.24 \pm 0.009	0.374	0.709
Total corneal thickness	551 \pm 32.5	544 \pm 35.6	0.865	0.390

Table 2. Comparison of visual functions between DES and NDES subjects (including CLW and -NCLW).

	DES N = 44			P-value	NDES N = 56			P-value	Sig.
	CLW n = 25 57%	NCLW n = 19 43%	Total n = 44 100%		CLW n = 17 30%	NCLW n = 39 70%	Total n = 56 100%		
Schirmer test	15.14 \pm 11.37	20.55 \pm 13.99	17.48 \pm 12.71	0.164	19.03 \pm 7.16	22.79 \pm 7.72	21.65 \pm 7.69	0.092	0.059
TBUT test	3.4 \pm 1.61	3.89 \pm 2.07	3.61 \pm 1.82	0.379	5.67 \pm 2.92	5.96 \pm 4.45	5.88 \pm 4.03	0.810	0.000
VA	0.0 \pm 0.00	0.0 \pm 0.00	0.0 \pm 0.00		0.01 \pm 0.034	0.0 \pm 0.016	0.01 \pm 0.023	0.179	0.051
CS	2.25 \pm 0.01	2.25 \pm 0.00	2.25 \pm 0.008	0.390	2.25 \pm 0.00	2.25 \pm 0.011	2.25 \pm 0.009	0.351	0.709
TCT	557.09 \pm 29.68	542.78 \pm 35.29	551.07 \pm 32.50	0.184	563.38 \pm 31.17	535.35 \pm 34.49	544.96 \pm 35.96	0.007	0.390

Measurement are showed in Mean \pm SD.

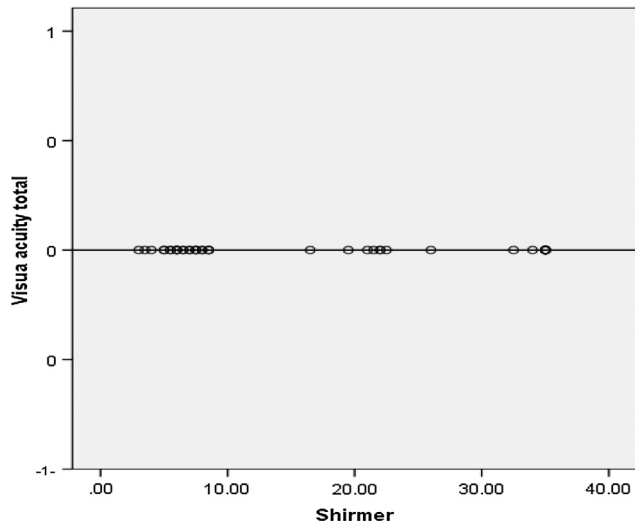


Fig. 1. Correlation between Schirmer test and VA in DES group (Including CLW and NCLW) the figure shows no correlation and no significant difference between VA and Schirmer test.

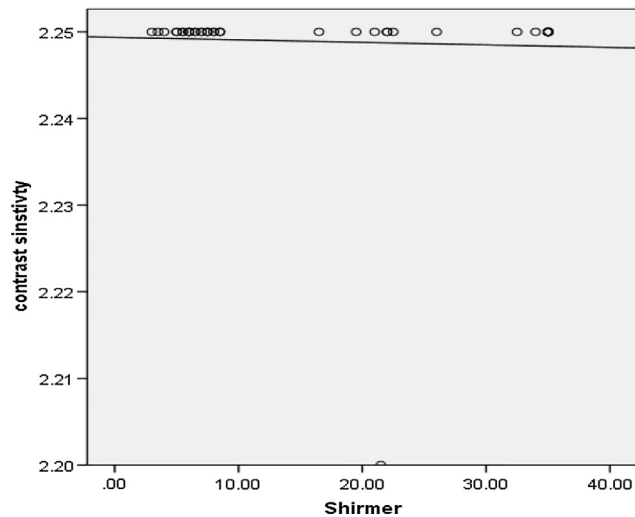


Fig. 2. Correlation between Schirmer test and CS in DES group (including CLW and NCLW). The figure showed weak positive correlation but no significantly difference.

DES group, VRQOL was compared between CL and NCLW groups (Table 3). The results showed that there were significant differences in nine items ($P < 0.05$) between CLW and NCLW. Subjects who wore CL had higher score in items 8, 9, 21–28 than subjects who did not wear CL.

Discussion

Dry eye disease is characterized by symptoms of ocular dryness and discomfort, which can affect the visual functions and impact negatively on individuals' VRQOL. This cross-sectional study was carried out to evaluate VA, CS and TCT as well as VRQOL in patients with DES including CLW and NCLW. In this study, no correlation was found between DES and visual functions (Figs. 1 & 2). Unlike previous studies found that DES had negative impact on VA and CS.^{1,15,26,27} Goto et al.¹¹ measured surface regularity index (SRI) of

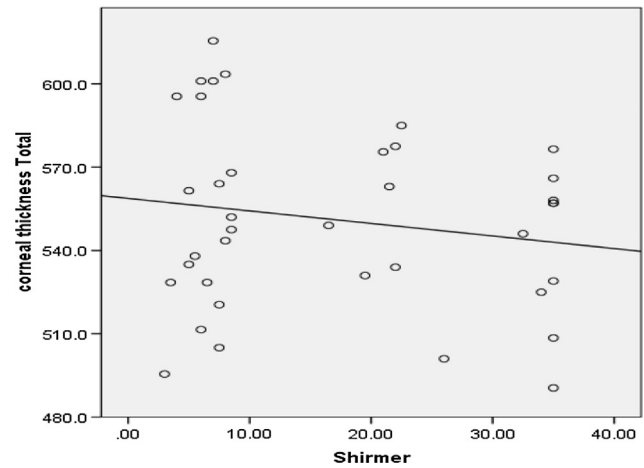


Fig. 3. Correlation between Schirmer and TCT in DES group (including CLW and NCLW). The figure shows weak positive correlation but not significantly difference.

corneal topography subjects with DES and found that subjects who had lower SRI as an indication of dryness, had also lower VA and CS than NDES subjects.

It was reported in the introduction that gender factor would contribute the prevalence of DES. Galora et al.²⁶ found that VA and CS were decreased among DES subjects in both gender, particularly in female subject. The differences in results between the present study and previous studies could be due to many factors such as the range of subjects' age, gender and the diagnostic criteria used. Moss et al.⁴ found that dryness was higher among elderly who aged between 48 and 91 years than younger subjects aged less than 60 years. In addition, they found that DES was higher among female than male. Meiyani et al.¹⁶ used Schirmer test as a diagnostic examination to assess dryness. Similarly, the present study used Schirmer test to diagnose DES. However, the variation in the results between the current study and Meiyani et al.'s study may be because both gender were included in their study with large sample size. Likewise, this indicates that dryness was gender related and could be affected by age.

The present study found that TCT was affected by dryness (Fig. 3) as there was a negative correlation between TCT and dryness in NDES group (including CLW and NCLW). Similarly, Sanchis et al.⁶ measured corneal thickness in female DES ($n = 30$) and NDES ($n = 32$) and found that corneal thickness was decreased in participants who had dryness ($P < 0.001$). This result was expected as the tear film is one of the anterior surface components of the eye that can affect corneal thickness. This indicates that corneal thickness can be increased with decreasing the dryness.

Vision-related QOL was affected by DES especially in CL wearers. We found that the psychological well-being and convenience domains were the most aspects of VRQOL affected by dryness. This result was supported by Abetz et al.²⁸ who assessed VRQOL of subjects with DES using The Impact of Dry Eye on Everyday Life (IDEEL) questionnaire and found that there was correlation between dryness and emotional and inconvenience domains. Subjects with DES had lower scores in emotional and inconvenience domains than NDES subjects. Meiyani et al. assessed VRQOL in 87 subjects with DES using two instruments: The National Eye

Table 3. Comparison between responses of DES and NDES participants and CLW and NCLW on the 28 items CLIQ Questionnaire.

Item description	DES N = 44 Mean ± SD	NDES N = 56 Mean ± SD	Sig.	CLW with DES N = 25 Mean ± SD	NCLW with DES N = 19 Mean ± SD	Total Sig.
1. How much difficulty do you have driving in glare conditions?	1.93 ± 0.81	1.89 ± 0.77	0.816	1.88 ± 0.78	2.00 ± 0.88	0.714
2. How much difficulty do you have performing any activity due to dim lighting?	2.18 ± 0.84	1.83 ± 0.84	0.140	2.00 ± 0.86	2.42 ± 0.76	0.128
3. During the past month, how often have you experienced your vision changing/fluctuating throughout the day, either improving or deteriorating?	1.86 ± 0.90	1.66 ± 0.81	0.943	1.84 ± 0.89	1.89 ± 0.93	0.849
4. During the past month, how often have you experienced focusing difficulties?	1.84 ± 0.68	1.89 ± 0.80	0.513	1.72 ± 0.67	2.00 ± 0.66	0.170
5. During the past month, how often have you experienced your eyes feeling tired or strained?	2.59 ± 0.81	2.33 ± 0.81	0.840	2.48 ± 0.91	2.73 ± 0.64	0.275
6. During the past month, how often have you experienced red/painful/itchy/burning/sore/uncomfortable/gritty or dry eyes?	2.36 ± 0.91	2.21 ± 1.03	0.711	2.52 ± 1.00	2.15 ± 0.76	0.170
7. How much trouble is the routine care of your optical correction to preform cleaning, using eye drops, changing frame, etc.?	1.40 ± 0.69	1.26 ± 0.64	0.166	1.44 ± 0.71	1.36 ± 0.68	0.612
8. How much trouble is having to think about optical correction before doing things (traveling, sport, going swimming)?	1.65 ± 0.98	1.55 ± 0.97	0.540	1.96 ± 1.13	1.26 ± 0.56	0.032
9. How much trouble is having to carry additional cleaning supplies for optical correction when traveling?	1.40 ± 0.81	1.23 ± 0.66	0.407	1.64 ± 0.95	1.10 ± 0.45	0.020
10. How much trouble is having to insert and wear things in your eyes?	1.81 ± 0.89	2.00 ± 1.04	0.331	1.68 ± 0.74	2.00 ± 1.05	0.378
11. How much trouble is being unable to have good, comfortable vision all day?	1.95 ± 0.91	1.69 ± 0.78	0.392	1.96 ± 0.88	1.94 ± 0.97	0.920
12. How much concerned are you about the initial and ongoing cost of buying your current optical correction?	1.61 ± 0.99	1.42 ± 0.73	0.856	1.76 ± 1.01	1.42 ± 0.96	0.147
13. How much concerned are you about the cost of your next optical correction?	1.59 ± 0.97	1.51 ± 0.76	0.574	1.80 ± 1.11	1.31 ± 0.67	0.135
14. How much concerned are you about the cost of unscheduled maintenance of your optical correction breakage, loss, running out of supplies?	1.70 ± 1.04	1.41 ± 0.75	0.296	1.88 ± 1.09	1.47 ± 0.96	0.150
15. How much concerned are you about having to rely increasingly on optical correction since you started to wear them?	2.45 ± 1.19	2.55 ± 1.15	0.863	2.72 ± 1.20	2.10 ± 1.10	0.096
16. How much concerned are you about your vision being not as good as it could be with your optical correction?	2.63 ± 1.20	2.39 ± 1.18	0.462	2.88 ± 1.20	2.31 ± 1.15	0.121
17. How much concerned are you about medical complications from your optical correction?	2.34 ± 1.18	2.39 ± 1.12	0.916	2.64 ± 1.22	1.94 ± 1.02	0.062
18. How much concerned are you about eye allergies/infections?	2.93 ± 0.94	2.51 ± 1.04	0.154	3.08 ± 0.86	2.73 ± 1.04	0.276
19. How much concerned are you about falling asleep in your optical?	2.27 ± 1.06	2.10 ± 1.12	0.967	2.32 ± 1.02	2.21 ± 1.13	0.703
20. How much concerned are you about eye protection from ultraviolet (UV) radiation?	2.27 ± 1.04	2.19 ± 0.92	0.314	2.20 ± 1.04	2.36 ± 1.06	0.619
21. During the past month, how much of the time have you felt that you have looked your best when wearing optical correction?	2.27 ± 1.30	1.48 ± 0.83	0.008	2.96 ± 1.17	1.36 ± 0.83	0.000
22. During the past month, how much of the time have you felt happy with your facial appearance when wearing optical correction?	2.34 ± 1.31	1.67 ± 1.02	0.057	3.04 ± 1.13	1.42 ± 0.90	0.000
23. During the past month, how much of the time have you felt that others see you the way you would like them to (e.g., intelligent, sophisticated, successful, cool) when wearing optical correction?	1.97 ± 1.26	1.37 ± 0.72	0.088	2.36 ± 1.31	1.47 ± 1.02	0.014
24. During the past month, how much of the time have you felt complimented/flattered when wearing optical correction?	2.13 ± 1.35	1.26 ± 0.64	0.006	2.68 ± 1.34	1.42 ± 1.01	0.001
25. During the past month, how much of the time have you felt confident when wearing optical correction?	2.13 ± 1.26	1.51 ± 0.93	0.044	2.68 ± 1.21	1.42 ± 0.96	0.001
26. During the past month, how much of the time have you felt happy when wearing optical correction?	2.00 ± 1.27	1.62 ± 1.00	0.460	2.56 ± 1.32	1.26 ± 0.73	0.001
27. During the past month, how much of the time have you felt able to do the things you want to do when wearing optical correction?	2.34 ± 1.36	1.82 ± 1.09	0.337	2.80 ± 1.38	1.73 ± 1.09	0.010
28. During the past month, how much of the time have you felt eager (keen) to try new things when wearing optical correction?	2.06 ± 1.22	1.53 ± 0.93	0.117	2.40 ± 1.29	1.63 ± 1.01	0.039

Institute Visual Function (NEI VFQ-25) questionnaire²⁹ and OSDI questionnaire.³⁰ The results showed that dryness group had worse score in all aspects of VRQOL, which was correlated with anxiety and depression.

There are some limitations in this study. The participants of this study were only female of students and staff at king Saud University. This gender limitation was caused by the methodological basis of the study. Also, dryness was assessed by TBUT and Schirmer test. There are new advanced measurements such as tear lab device and keratography that can be used for the diagnoses of DES. However, it

was aimed to use these measurements in this study but unfortunately these measurements were not available during collecting the data. Another limitation is that the severity of dryness was not classified. Therefore, it was difficult to identify the exact impact of dryness on visual function and TCT as well as VRQOL. Therefore, future study may needed to investigate the effect of DES on visual function and VRQOL on both gender. This was the first study conducted in Saudi Arabia that investigated the impact of DES on visual functions and VRQOL. Therefore, further studies may require to support the present findings.

Conclusion

The results of this study indicate that dryness has no effect on visual function in both CLW and NCLW. A negative correlation between TCT and dryness was expected as the tear film is one of the anterior surface components that affect corneal thickness. However, psychological and convenience aspects of VRQOL were affected negatively in Saudi female patients with DES, especially CLW.

Conflict of interest

The authors declared that there is no conflict of interest.

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