Epidemiology of dry eye syndrome in Hong Kong: a cross-sectional population-based study

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Abstract

Aims: To evaluate the epidemiology of dry eye syndrome in a population-based sample in Hong Kong and to assess the correlation between findings from Ocular Surface Disease Index questionnaire and Schirmer's test.

Method: In this cross-sectional study in a health promotion program, all subjects were asked to complete the Ocular Surface Disease Index questionnaire and those who scored above 20 were asked to undergo Schirmer's test with topical anesthesia.

Results: A total of 235 subjects were recruited of whom 110 underwent the Schirmer's test. The prevalence of dry eye syndrome was estimated to be 7.7% using a definition including both subjective and objective measurements. There was no significant correlation between the Ocular Surface Disease Index scores and average Schirmer's test scores (Spearman rho = 0.075, p = 0.44). Older subjects (aged 46-55 years) had a significantly higher mean index score than younger persons (aged 18-25 years) [p = 0.006]. An inverse correlation between daily hours of computer use and Schirmer's test scores was noted (Spearman rho = –0.20, p = 0.032).

Conclusions: Dry eye syndrome is a prevalent condition locally. Although the Chinese-translated version of the Ocular Surface Disease Index was found to be a useful and convenient instrument in evaluating symptoms of dry eye syndrome, its use as the sole instrument to diagnose dry eye syndrome in this locality appears questionable.

Introduction

Dry eye syndrome (DES) is a common disorder, which can present with various eye symptoms (grittiness, burning sensation, tearing, ocular discharge, pain, and even blurring of vision). The Definition and Classification Subcommittee of the International Dry Eye WorkShop has defined DES as "a multifactorial disease of the tears and ocular surface that results in symptoms of discomfort, visual disturbance, and tear film instability" with the potential to damage ocular surfaces and is accompanied by increased osmolarity of the tear film and inflammation of ocular surfaces.[1] It has been estimated that up to 25% of patients report symptoms of DES in general ophthalmology clinics.[2] It has also been reported that DES is more commonly encountered in women and the elderly, and is associated with contact lens wear, systemic drug effects, autoimmune diseases, and refractive surgery.[3-6]

Clinical tools commonly used in grading DES can be based on symptoms, obtained by questionnaires such as the Ocular

Surface Disease Index (OSDI), National Eye Institute Visual Function Questionnaire (NEIVFQ-25), or McMonnies Dry Eye Questionnaire. Objective approaches to assessing DES include: tear film breakup time (TBUT), fluorescein or lissamine green staining of the cornea and conjunctiva, meibomian secretion scoring, Schirmer's test and tear osmolarity.[7] Ocular surface inflammation is associated with increase in matrix metalloproteinase-9 (MMP-9) in tears, which correlates with the severity of DES.[8] Various therapies are available for the treatment of DES and include lubricating the ocular surface, increasing the secretion of tears, conservation of tears, or targeting any associated ocular surface inflammation.

The OSDI developed by the Outcomes Research Group at Allergan Inc (Irvine, CA, USA) may be a useful tool for DES evaluation due to its simplicity and ease of use. It is a 12-item scoring survey, in which the subject rates his or her own ocular symptoms induced by environmental factors over the preceding 2 to 4 weeks. Answers are scored on a scale of 0 to 4; the total score can range from 0 to 100, with higher score representing greater disability. In a study comparing the OSDI and other dry eye questionnaires, the former was reported to be reliable (ranging from good to excellent as an overall instrument) and have high validity.[9]

Ozcura et al[10] investigated the correlations between OSDI score and findings from Schirmer's test (without anesthesia), and the TBUT in 68 patients. Results found an inverse correlation between OSDI and TBUT scores, but there was no correlation between findings of the OSDI and Schirmer's test without anesthesia. The authors concluded that the OSDI was a reliable instrument for evaluating DES symptoms, and suggested performing Schirmer's test with topical anesthesia to eliminate reflex epiphora and improve the correlation of OSDI and Schirmer's test findings. Locally, the prevalence of DES has not been determined using symptomatology questionnaires or clinical tests. In this study we aimed to investigate the epidemiology of DES in Hong Kong using the Chinese version of OSDI and Schirmer's test (with topical anesthesia) and to evaluate any possible correlation between their results.

Patients and methods

The study was performed as part of a local health promotion program titled "Dry Eye Day" on 3 April 2011, and was cohosted by the Hong Kong Ophthalmological Society and the College of Ophthalmologists of Hong Kong. All subjects gave verbal consent for OSDI and written consent to undergo Schirmer's test. Subjects were randomly recruited from the general public in a shopping mall. Eligible subjects had to be aged 18 years or more, have no history of ocular surgery, and have not been using any form of topical ophthalmic treatment. Subjects with contact lens wear were excluded from undertaking Schirmer's tests. All subjects were mentally capable of consenting. The research protocol was approved by an institutional review board and accorded with the Declaration of Helsinki.

The web-based Chinese version of the OSDI was used and administered by trained volunteer medical students under close supervision of ophthalmologists. The contents of the Chinese version of OSDI were provided by Allergan Inc (Irvine, CA, USA).[11] Subject age ranges were categorized as: 18-25 years, 26-35 years, 36-45 years, 46-55 years, 56-65 years, and 66 years or above. Each subject's gender, work environment, and duration of computer work per day were recorded. Subjects who scored over 20 (moderate to severe) on the OSDI questionnaire were recruited to undergo Schirmer's test with topical anesthesia. After instillation of one drop of topical oxybuprocaine 0.4% in each eye, standard filter papers (Whatman 41; Alcon Laboratories, Fort Worth, TX, USA) were placed in the inferior fornix of each eye at the junction of the middle and lateral thirds of the lower eye lid for 5 minutes by trained ophthalmic nurses or ophthalmologists. The patient was instructed to look straight ahead and to blink normally during the procedure. After 5 minutes, the filter papers were removed and the extent of wetting was measured and recorded. The mean Schirmer's test scores of the right and left eyes were used for the statistical analysis.

All data were entered into a computer spreadsheet program (Microsoft Excel; Microsoft Inc., Redmond, WA, USA) and analyzed using statistical software (StatPlus:mac 2009; AnalystSoft Inc., Vancouver, BC, Canada). One-way analysis of variance with Fisher's test for least significant difference was used to compare OSDI scores in different age-groups. As for the correlation and comparison analyses between OSDI findings and gender, age, contact lens wear, daily hours of computer work, and Schirmer's test results, Spearman correlation test and the Mann Whitney U test were used. A p value of <0.05 was considered to be statistically significant.

Results

Of the 235 subjects who answered the OSDI questionnaire, 173 (74%) were female and 62 (26%) were male, and the 46-to-55 years olds contributed to the largest proportion of respondents (30%; **Table**). There was a predominance of non-contact lens wearers (92%), and majority (68%) spent

Table. Age-groups, distribution of responses according to gender and mean Ocular Surface Disease Index (OSDI) scores of the study population.

Age-group (years)	No. (%) of respondents	No. (%) of females	Mean OSDI score
18-25	20 (9)	10 (50)	22.2*
26-35	16 (7)	8 (50)	22.7
36-45	20 (9)	16 (80)	35.3
46-55	71 (30)	57 (80)	36.7*
56-65	58 (25)	46 (79)	30.7
≥66	50 (21)	36 (72)	28.7

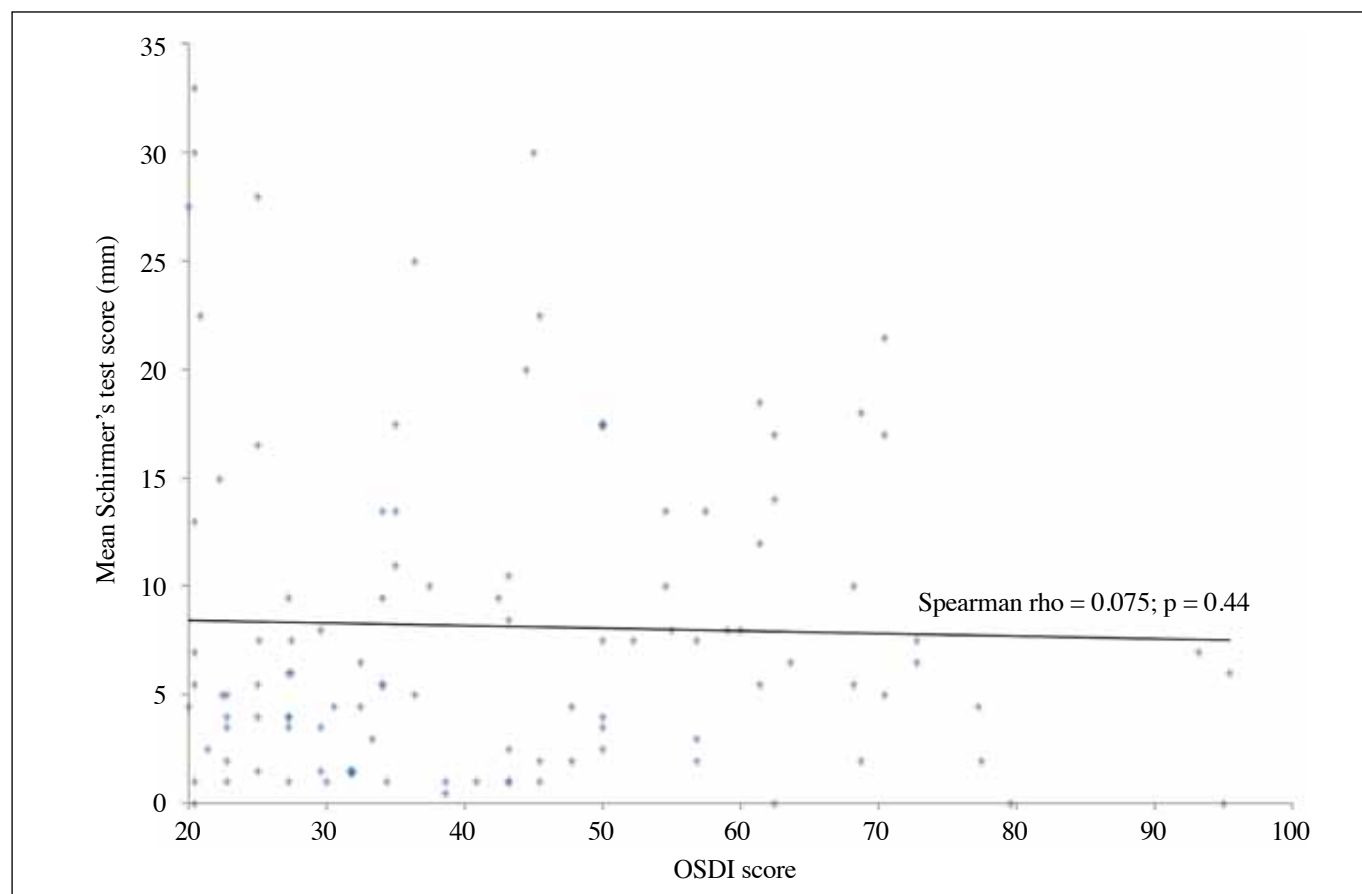* One-way analysis of variance Fisher's least significant difference, p < 0.05.

Figure 1. Correlation between Ocular Surface Disease Index score (OSDI) and Schirmer's test score.
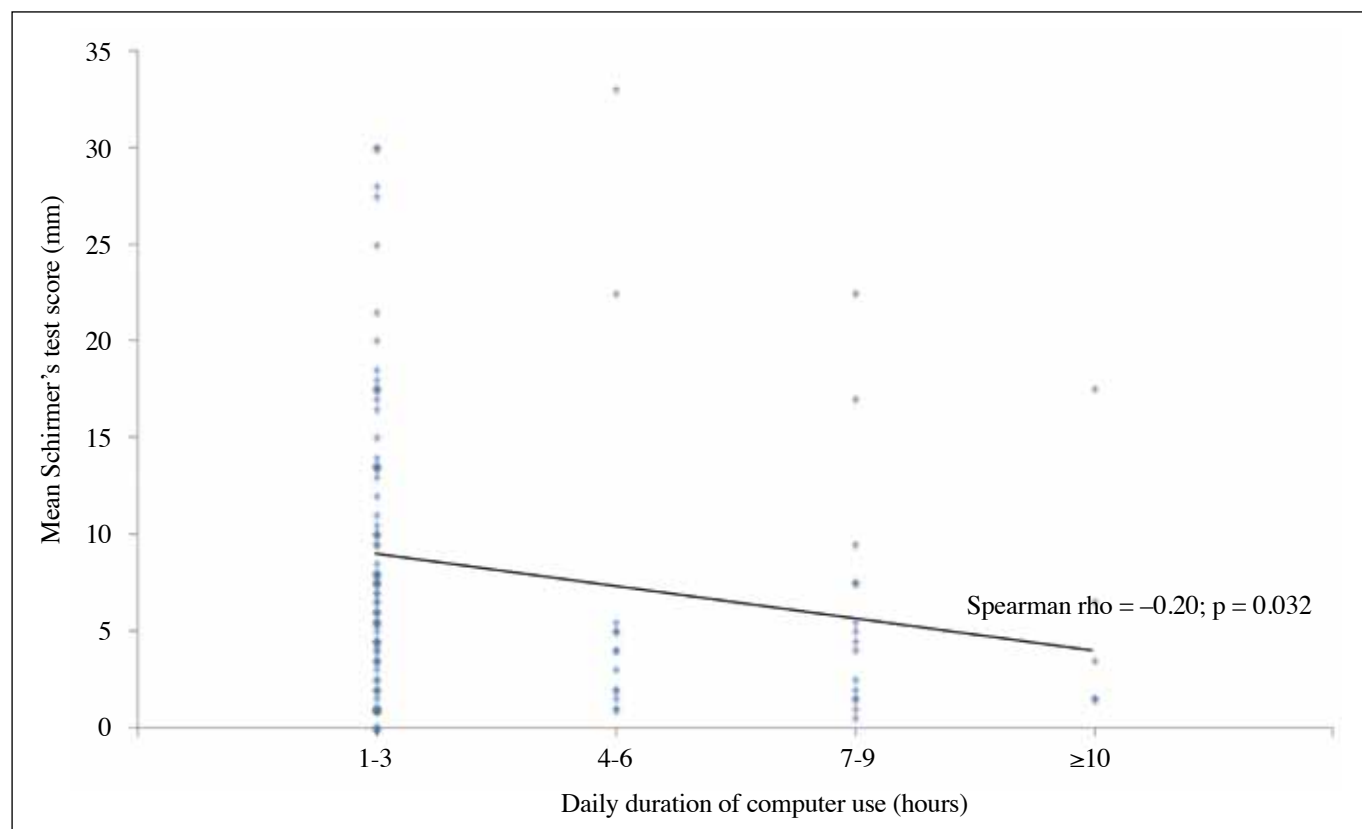

Figure 2. Correlation between Schirmer's test score and extent of computer usage.

less than 3 hours per day on computer work. The mean ± standard deviation (SD) OSDI score was 31 ± 21 (range, 0 to 95). There was no statistically significant difference in OSDI scores between genders (33 for females vs 27 for males; p = 0.10), contact lens wearing status (p = 0.28), and extent of computer work (p = 0.80). However, there was a statistically significant difference in OSDI scores between the youngest age-group (18-25 years) and an older age-group (46-55 years) [p = 0.006; **Table**].

A total of 110 subjects underwent Schirmer's tests with topical anesthesia in both eyes; right and left eyes scores correlated significantly between (Spearman rho = 0.73, p < 0.0001), and hence the average Schirmer's test scores of both eyes were used. The mean ± SD Schirmer's test score was 8.2 ± 7.6 mm (range, 0 to 33 mm). There was no statistically significant correlation between OSDI scores and average Schirmer's test scores (Spearman rho = 0.075, p = 0.44; **Figure 1**). Comparison between age-groups and Schirmer's test scores did not show any statistical significance. There was an inverse correlation between daily hours of computer use and Schirmer's test scores (Spearman rho = –0.20, p = 0.032; **Figure 2**). A statistically significant difference in Schirmer's test scores was found between the group with less than 3 hours per day of computer work and those with more than 3 hours per day of computer work (8.9 vs 6.4 mm, respectively; p = 0.026).

DES was defined as present if a subject had an OSDI score of greater than 55 (28 subjects) and a Schirmer's test score of less than 10 mm (77 subjects); by which criteria, 18 (8%) of the subjects were found to be affected.

Discussion

DES affects 5 to 30% of the population aged 50 years and older.[12] This proportion varies according to the criteria used for diagnosis and whether based on symptomatology, clinical tests or both. In this cross-sectional population-based study, the mean OSDI and Schirmer's test scores were 31 and 8 mm, respectively, and the prevalence of DES was 7.7% (based on subjective and objective measurements). This result was lower than a study from India, where based on the same criteria the prevalence was found to be 23%.[13] In that study however, the patients were from a tertiary eye center, whereas ours were recruited randomly from a shopping mall that may very well have resulted in a lower prevalence. With an aging population, increasing popularity of contact lens wear and computer use, many patients present to ophthalmology clinics with symptoms suggestive of DES. However, not all these patients actually fulfill the criteria of DES based on the aforementioned subjective and objective criteria.

In this study, we evaluated the correlation between findings of OSDI and Schirmer's test with topical anesthesia. Our results showed no statistically significant correlation between the two, as described by Nichols et al[14] in 75 patients. Ozcura et al[10] also reported no correlation using Schirmer's

test without topical anesthesia. The authors pointed out that the possibility of reflex tearing during the Schirmer's test might contribute to the lack of any correlation. Singh Bhinder[15] reported that the results from the Schirmer's test might vary according to reflex epiphora, and there was no correlation with DES symptoms. Our study demonstrated a lack of correlation, even with the possibility of reflex tearing minimized. In patients with severe dry eyes where the corneas are extremely desiccated, they might nevertheless report no ocular symptoms. Furthermore, symptoms of DES might be masked in patients with decreased corneal sensation (such as those with diabetes). This illustrates that OSDI does not correlate well with clinical tests for DES. Nonetheless, the OSDI may contribute to the management of DES as a standardized instrument to evaluate and monitor symptoms.

Newer studies have shown that tear hyperosmolarity and increased production and activity of MMP-9 in tears correlate positively with DES.[16] Although these tests are commercially available, e.g. TearLab Osmolarity System® (TearLab Corporation, San Diego, CA, USA) and RPS InflammaDry Detector™ (RPS, Inc. Saratosa, FL, USA), their costs are considerable. Hence simpler clinical non-invasive tests such as TBUT, the Schirmer's test and ocular staining with fluorescein, rose bengal and lissamine green are still preferred by most ophthalmologists.

Our study showed that there was a statistically significant difference in OSDI scores between a younger age-group (18-25 years) and certain older subjects (46-55 years), indicating that older patients may have more severe dry eye symptoms and may need more extensive workup by ophthalmologists. Notably, we also found a significant correlation between Schirmer's test scores and daily duration of computer work. The correlation and pathophysiology of computer vision syndrome (CVS) and aqueous tear deficiency has yet to be established. The term CVS was coined when a constellation of symptoms such as blurry vision, headaches, and dry and irritated eyes was associated with the use of digital display units. Treatment of CVS requires a multidirectional approach, combining ocular therapy with adjustment of workstations, including proper lighting, anti-glare filters, ergonomic positioning of computer monitors, and regular work breaks.[17] Our observation serves to raise awareness of a possible higher incidence of DES in the younger persons who work excessively with computer display screens.

Conclusion

DES is prevalent in our population. It is a multifactorial disease in which both subjective and objective measurements play an equal role in its diagnosis and management. Our study showed that the Chinese version of OSDI appears to provide a quick and reliable assessment of symptoms of DES in the local population. However, using the OSDI alone might not be adequate as a single diagnostic tool for this condition, and further objective tests are required.

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