Comparison of Two Questionnaires for Dry Eye Symptom Assessment

The Ocular Surface Disease Index and the Symptom Assessment in Dry Eye

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Purpose: The aim of this study was to compare patient-reported symptoms of dry eye disease (DED) as assessed by the Ocular Surface Disease Index (OSDI), a 12-item symptom frequency–based questionnaire, and the Symptom Assessment in Dry Eye (SANDE), a 2-item frequency– and severity-based visual analog scale.

Design: Clinic-based evaluation of a diagnostic test.

Participants: A total of 114 patients with DED.

Methods: Patients were administered the OSDI and SANDE questionnaires at baseline and follow-up visits to evaluate DED-related symptoms. The correlations between both questionnaires’ scores were evaluated using the Spearman coefficient, and their clinical differences were assessed using Bland–Altman analysis.

Main Outcome Measures: Baseline and follow-up visit OSDI and SANDE dry eye symptom scores.

Results: At the baseline visit, the OSDI and SANDE questionnaire scores were significantly correlated ($R = 0.64; P < 0.001$). Moreover, a significant correlation was found between changes in the OSDI and SANDE scores from baseline to follow-up visits ($R = 0.47; P < 0.001$). A Bland–Altman analysis, after score normalization, revealed a difference (bias) of less than 2 centesimal units between the scores of the 2 questionnaires.

Conclusions: Data collected from the SANDE questionnaire showed a significant correlation and negligible score differences with those from the OSDI, suggesting that the SANDE visual analog scale–based questionnaire has the potential to provide clinicians with a short, quick, and reliable measure for DED symptoms. Ophthalmology 2015;122:1498-1503 © 2015 by the American Academy of Ophthalmology.

Dry eye disease (DED) is a multifactorial disorder of the ocular surface that affects millions of people in the United States alone.1–3 It represents one of the most frequent reasons for ophthalmic consultations, with 5% to 30% of the general population affected depending on the diagnostic criteria used.3,4 Dry eye disease symptoms severely affect patients’ activities of daily living, either continuously or triggered by specific tasks (e.g., driving or computer monitor use).3 These symptoms include discomfort, blurred vision, burning sensation, irritation, photophobia, and contact lens intolerance.6 The measurement of patients’ signs and symptoms, and their impact on patients’ quality of life, are critical aspects in DED evaluation. Because there is no “gold standard” diagnostic test for DED, a combination of signs and symptoms are commonly used as diagnostic criteria.1

Because of the variability of dry eye symptoms and the limitations of the available clinical tests, questionnaires that record patients’ symptoms are useful tools for diagnosis and follow-up of DED.6,7 The Ocular Surface Disease Index (OSDI) (Allergan Inc, Irvine, CA)10 is one of the most frequently used instruments to assess DED. This questionnaire comprises 12 questions and evaluates the frequency of symptoms over the preceding week. The questionnaire requires approximately 5 minutes for the patient to complete, and the scores range from 0 to 100. On the basis of the score, the patient’s symptoms can be categorized as normal (0–12), mild dry eye (13–22), moderate dry eye (23–32), or severe dry eye (33–100).9–12 The OSDI is copyrighted by Allergan, Inc.

The Symptom Assessment in Dry Eye (SANDE) is a short and intuitive questionnaire based on a visual analog scale that quantifies both severity and frequency of dry eye symptoms. The SANDE comprises 2 questions, and each question uses a 100-mm horizontal linear visual analog scale. The measurement of symptom frequency ranges from “rarely” to “all of the time,” and the symptom severity ranges from “very mild” to “very severe.”3,11 It has been shown that both tests are reliable and valid measures of dry eye symptoms.11,13 The main objective of this study was to compare the SANDE and OSDI questionnaires in a clinic-based cohort of patients with DED. In addition, we sought to expand on evidence in support of the use of the SANDE questionnaire for DED diagnosis and follow-up.

Methods

This study was conducted in compliance with the institutional review board at the Massachusetts Eye and Ear Infirmary, Boston,
Massachusetts, in accordance with the tenets of the Declaration of Helsinki, and informed consent was obtained from all participants. Data were collected at the Cornea Service, Massachusetts Eye and Ear Infirmary, from patients who had a previous diagnosis of DED and were representative of the subset of DED seen in our clinic, a specialized ocular surface unit.

The OSDI and SANDE scores from baseline and follow-up visits of a total of 114 patients were analyzed. Patients were selected on the basis of the following criteria at the initial visit: punctate epithelial keratopathy (corneal fluorescein staining [CFS]) ≥0.5; symptoms of dry eye (e.g., burning, irritation, grittiness, foreign body sensation, or fluctuating vision); and OSDI ≥13.2 Patients who had signs of epitheliopathy (corneal staining) with minimal or no symptoms were not included; likewise, those with symptoms of ocular irritation but without signs of epitheliopathy were not included. Patients with active infection, history of allergy, refractive surgery, penetrating keratoplasty, and herpetic eye disease, as well as contact lens wearers, were excluded. Corneal fluorescein staining was evaluated using commercially available fluorescein sodium strips, followed by slit-lamp examination with cobalt-blue light. Three minutes after application of fluorescein, CFS was graded using the modified Oxford system (grades 0–5). At both visits, patients were asked to complete the OSDI and SANDE questionnaires, and the results were used to evaluate their symptoms.

The 12-item OSDI questionnaire scores range from 0 to 100, and it contains 3 ocular symptom questions, 6 vision-related function questions, and 3 environmental trigger questions. Each question score ranges from 0 (“none of the time”) to 4 (“all of the

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CFS = corneal fluorescein staining; OSDI = Ocular Surface Disease Index; SANDE = Symptom Assessment in Dry Eye; SD = standard deviation.

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The total score is calculated on the basis of the following formula: \( \text{OSDI} = \left( \frac{\text{sum of scores for all questions answered}}{\text{total number of questions answered}} \times 100 \right) / \left( \frac{\text{total number of questions answered}}{4} \right) \). \(^{10,11}\)

The SANDE questionnaire comprises 2 questions: (1) How often do your eyes feel dry and/or irritated? and (2) How severe do you feel your symptoms of dryness and/or irritation are? This questionnaire uses a 100-mm horizontal line for each question to assess ocular discomfort and/or dryness experienced by the patients. In the SANDE questionnaire, frequency of symptoms ranges from “rarely” to “all of the time,” and the severity of symptoms ranges from “very mild” to “very severe” (Fig 1). \(^{13,14}\) At each visit, patients were asked to place a mark on the 2 given lines based on the extent of their symptoms. The locations of the marks made by the patients on the 100-mm horizontal lines were measured in millimeters from left to right and recorded. Data collected from the SANDE questionnaire were calculated by multiplying the frequency score by the severity score and obtaining the square root. \(^{13,14}\)

We then assessed the correlation between data obtained from the 2 questionnaires, including the change in symptoms between the 2 visits. Statistical analysis of the data and correlations between the questionnaires responses were assessed by the Spearman coefficient of correlation. A \( P \) value of less than 0.05 was considered statistically significant. In addition, we evaluated the clinical differences between OSDI and SANDE using Bland–Altman analysis. \(^{15}\) First, we compared the original scores obtained from the 2 questionnaires. Because the 2 methods do not measure symptoms in the same way (although both use a centesimal scale), we normalized the scores by applying the algebraic method of the norm of a vector (normalization to a norm of 1). Once the scores from both questionnaires were transformed to a normalized scale, we compared them using Bland–Altman analysis. Normalization was obtained by: 1) summing the squares of all the scores (\( \sum y^2 \)); and 2) obtaining the square root of this sum (\( \sqrt{\sum y^2} \)), then 3) dividing each of the original scores by \( \sqrt{\sum y^2} \) to obtain each of the final normalized individual scores (the square root of the sum of the squared normalized scores equals 1 for all the data sets transformed). Finally, we divided the one (text) SANDE score that was equal to 100 by its normalized value (to obtain their ratio) and multiplied all the normalized scores by the same figure (ratio) to ultimately transform all the normalized scores back to a centesimal scale.

**Results**

We evaluated 114 patients (43 men and 71 women) at 2 different visits (baseline and follow-up). The average age of the subjects was 51.8±15 years (Table 1). The mean time interval between the baseline and follow-up visits was 81±43 days (median, 71 days; range, 20–283 days).

At the baseline visit, symptom severity data collected by the SANDE questionnaire ranged from 4 to 100, and the symptom frequency ranged from 7 to 100. The mean SANDE score was 63.48±23.49. The OSDI ranged from 13 to 100, with a mean score of 48.9±22.42. On the basis of scores generated by the OSDI questionnaire, of the 114 patients evaluated, 84 (73.7%) reported severe ocular surface symptoms (33–100) and 30 (26.3%) reported mild to moderate symptoms (13–33). \(^{12}\) At the baseline visit, CFS scores ranged from 0.5 to 5, with a mean score of 2 (±1.6) (Table 1).

At the follow-up visit, symptom frequency, as measured by SANDE, ranged from 1 to 100, and symptom severity ranged from
0 to 100. The mean SANDE score was 52.1 ± 24. Symptom frequency, as measured by the OSDI, ranged from 0 to 100, with a mean score of 43.25 ± 22.9.

Spearman correlation coefficient results revealed a significant correlation between the OSDI and SANDE scores at the baseline visit (R = 0.64; P < 0.0001) (Fig 2A). On the basis of the data generated by the OSDI questionnaire, patients were categorized with severe DED (OSDI ≥ 33; n = 84) or mild to moderate DED (OSDI 13–33; n = 30).12 At the baseline visit, there was a significant correlation between OSDI and SANDE scores in patients with severe DED (R = 0.39; P < 0.0001) (Fig 2B). In patients with mild to moderate DED, a significant correlation between OSDI and SANDE scores was also noted (R = 0.37; P = 0.045) (Fig 2C).

Changes in patients’ dry eye symptoms from baseline to follow-up visits, as scored by the OSDI and SANDE, were evaluated, revealing a significant correlation (R = 0.47; P < 0.0001) (Fig 3A). The correlation coefficient between symptom changes in patients with severe DED, as scored by the OSDI and SANDE, was also significant (R = 0.46; P < 0.0001) (Fig 3B). Likewise, there was a significant correlation between the changes scored by the OSDI and SANDE in patients with mild to moderate DED symptoms (R = 0.42; P = 0.02) (Fig 3C). Overall, the OSDI significantly correlated with the SANDE severity (R = 0.62; P = 0.0001) and frequency (R = 0.60; P = 0.0001) scores.

To determine the utility of measuring both frequency and severity with the SANDE questionnaire, we evaluated the correlation between the SANDE severity and the frequency changes from baseline to follow-up visit (R = 0.57; P < 0.0001). In some patients, the frequency of symptoms decreased, whereas there was no change in severity or vice versa. If the regression were linear, it would be unnecessary to measure both frequency and severity and measuring one would be enough, but that was not the case (Fig 4).

Bland–Altman analysis for clinical agreement between the normalized OSDI and SANDE scores revealed a clinical difference (bias) of −1.5 units for the baseline visit and 1.8 units for the follow-up visit (Fig 5).

**Discussion**

Dry eye disease, a common disorder of the ocular surface, is a multifactorial condition that can present with various symptoms, complicating diagnosis and treatment. Although a number of questionnaires are available to measure dry eye symptoms, a valid, short, and easily comprehensible questionnaire that allows for the monitoring of symptom frequency and severity over time is essential. The OSDI is a validated questionnaire that measures only the frequency of dry eye symptoms. By contrast, the SANDE is an intuitive and quick questionnaire that measures both severity and frequency of DED symptoms. It has shown reproducibility, satisfactory validity, repeatability, sensitivity, and specificity in assessing patients with ocular surface disease.

In this study, we compared the short visual analog scale–based SANDE questionnaire with the longer OSDI questionnaire in evaluating and monitoring symptoms in a subset of patients with DED and concurrent signs and symptoms of the disease. The SANDE scores at the baseline visit correlated well with those of the OSDI. Likewise, the correlation between changes in OSDI and SANDE scores, from baseline to follow-up visits, remained significant. Moreover, SANDE scores correlated well with those of the OSDI when the questionnaire was administered to subgroups of patients with severe or mild to moderate DED (based on OSDI baseline scores).

Although there was a statistically significant correlation between the 2 questionnaires, when clinical agreement was
evaluated using the original scores from both questionnaires, Bland–Altman analysis revealed that SANDE scored 14 units higher than OSDI. This is in agreement with the results reported by Chen et al., who found that SANDE consistently scored symptoms higher than OSDI in various groups of patients with DED. A difference of 14 points would be of clinical significance according to Miller et al. However, when algebraic-vectorial normalization was applied to the scores obtained with both questionnaires, we found a difference of less than 2 units. Although the magnitude of this difference remained constant in the 2 different measurements (baseline and follow-up), the signs alternated between both measurements, supporting the idea that the difference is negligible.

The SANDE is a short, intuitive tool that consists of 2 simple questions. By contrast, the OSDI requires the patient to read, understand, and answer 12 questions. Although the OSDI questionnaire is unequivocally an established and well-recognized method for evaluating DED symptoms, it is not completely clear that it offers genuine advantages over the SANDE questionnaire. Finally, the OSDI is copyrighted by Allergan Inc, potentially limiting its use by other industry concerns for pivotal clinical trial use for drug registration purposes.

The correlations shown between OSDI and SANDE scores, coupled with their clinically negligible differences obtained from Bland–Altman analysis of the normalized data, suggest that the SANDE questionnaire scores are equivalent to those from the OSDI. In this regard, the SANDE questionnaire seems to hold promise as a quick and valid method for evaluating the frequency and severity of symptoms of patients with DED.

References

Footnotes and Financial Disclosures

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Abbreviations and Acronyms:
CFS = corneal fluorescein staining; DED = dry eye disease; OSDI = Ocular Surface Disease Index; SANDE = Symptom Assessment iN Dry Eye.

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