Instrument Development of the UNC Dry Eye Management Scale

By

Joseph Grubbs, Jr.

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Sue Tolleson-Rinehart, PhD, Advisor

Date

Richard M. Davis, MD, Second Reader

Date
ABSTRACT

Dry Eye Disease (DED) is a chronic disease that diminishes the quality of life (QOL) of millions of Americans. Clinical tests of DED poorly correlate with patient-reported symptoms, and current dry eye questionnaires that include QOL measures require considerable time and effort to complete. Therefore, as part of a research team in the University of North Carolina (UNC) Ophthalmology Department, I helped develop a single-item, patient-reported dry eye scale that conveys both the patient’s dry eye symptoms and the effects of these symptoms on the patient’s quality of life. Our initial questionnaire development consisted of two phases: conceptualization and questionnaire development and cognitive interviewing and questionnaire modification. During phase one, we performed an extensive literature review and consulted multiple patients and experts to create the conceptual framework for our dry eye questionnaire. During phase 2, we administered this preliminary questionnaire to multiple dry eye patients; then, using cognitive interviewing techniques, we asked these patients several questions about the questionnaire. In total, 18 patients were interviewed, and their input led to further modifications of our dry eye scale and ultimately led to the final product: the UNC Dry Eye Management Scale (UNC DEMS). Validity and reliability testing of this dry eye scale are ongoing, but early statistical analyses indicate that the UNC DEMS is a valid patient-reported measure of both symptoms and QOL in DED. Our hope is that this tool will assist both clinicians and patients in the monitoring and management of DED in the time-constricted clinical setting.
ACKNOWLEDGMENTS

First, I would like to thank Dr. Richard M. Davis, my preceptor and second reader, for his inviting me to participate in this research study. I am truly grateful not only for his guidance throughout this project but even more so for his mentorship of me as a future ophthalmologist. I could not have asked for a better preceptor. Second, I want to thank Dr. Anthony Viera, my practicum advisor, for his supervision and assistance—especially in the early portion of my practicum experience. Third, I would like to thank Kyle Huynh and Dr. Jennifer Williamson for their work in the early development of the UNC DEMS. I especially want to thank Kyle for being my fellow student-researcher throughout this instrument development project. His academic insights and hard work all greatly contributed to the success of this study. In addition, I wish to thank Dr. Kathleen Gordon for letting us interview patients in her clinic. I am also extremely grateful to each of the 18 patients who contributed to the development of the UNC DEMS through their cognitive interviews. Finally, I would like to thank Dr. Sue Tolleson-Rinehart, my advisor and first reader, for her teaching, mentorship, and investment throughout this project. Her advice and guidance to me both as a researcher and a public health student have been truly invaluable. Without her, neither I nor the UNC DEMS would be where we are today.
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INTRODUCTION

Dry eye disease (DED) is a common ocular disease with a prevalence of 5-17% in the United States. The disease affects approximately twice as many women as men, and disease prevalence increases with age. DED is a chronic disease characterized by many different symptoms including ocular pain, grittiness, burning, foreign body sensation, tearing, and photophobia. Multiple studies have confirmed that the disease diminishes a person’s quality of life (QOL). Specifically, DED symptoms can impede patients’ abilities to read, use a computer, drive, and perform basic work activities. In addition, a recent study has shown that DED’s negative effects on QOL increase as disease severity increases from mild to moderate to severe and can ultimately lead to individuals missing work due to the severity of their symptoms.

Two recent utility assessments compared DED with several other chronic conditions known to diminish QOL. Utility assessments often use the time trade-off method (TTO) in which patients are provided their current life-expectancy in years and asked how many years they would be willing to give up to be free from a given disease or condition. For example, in the case of DED, a patient may be asked “Would you rather live 30 years with dry eye or 25 years totally cured from dry eye?” The question is repeated with years gradually decreasing for the disease-free option until the patient selects living with the disease for his or her full life expectancy. The fewest number of years the patient is willing to live in order to live disease-free is then divided by the initial life expectancy to produce the final utility score. Although these utility scores are useful in and of themselves, studies have shown that lower utility scores also correlate with worse QOL. In the aforementioned utility assessments, scores calculated for moderate to severe dry eye ranged from 0.58 to 0.86 and were similar to (and in some cases lower than) the utility scores of other chronic conditions such as dialysis, severe angina, and hip fractures. These low utility scores clearly indicate how severely DED can diminish QOL.
BACKGROUND AND SIGNIFICANCE

Despite the increasing evidence that DED diminishes QOL, only two patient-reported dry eye questionnaires specifically assess QOL in patients who have DED: the Ocular Surface Disease Index (OSDI)\(^1\) and the Impact of Dry Eye on Everyday Life (IDEEL).\(^4,6,12\) These two questionnaires have proven particularly valuable in clinical trials.\(^2,4-6,8,9,13\) The overall dearth of DED questionnaires that include QOL assessment, however, is concerning considering the weak correlation between clinical measures of dry eye disease and patient-reported symptoms.\(^4,6,7\) The small correlation between physician and patient assessment of severity of DED in the clinic further highlights the need for reliable patient-reported measures of QOL in DED patients.\(^3\) The US Food and Drug Administration (FDA) has recently emphasized the necessity of using QOL measures and other patient-reported outcome measures (PROs) to monitor treatment efficacy.\(^5\) In 2006, the FDA published guidelines for the proper instrument development of these PROs—including recommendations such as forming a conceptual framework, performing reliability and validity testing, and involving patients in instrument development.\(^14\) This is only a small indication of the growing paradigm favoring patient-reported outcomes in policy, health system models of delivery, and even reimbursement. Other federal agencies have also increased their emphasis on PROs; for example, the National Institutes of Health (NIH) developed the Patient-Reported Outcomes Measurement Information System (PROMIS) in 2004 to provide an online resource to assist in the development of reliable PRO measures and questionnaires.\(^15\) All these factors drive the goal of this research study: To produce a patient-centered, patient-reported dry eye scale that conveyed both the patient’s dry eye symptoms and the effects of those symptoms on the patient’s quality of life.

METHODS

The initial instrument development of the University of North Carolina Dry Eye Management Scale (UNC DEMS) consisted of 2 phases—conceptual development of the scale and modification of the scale guided by cognitive interviewing of patients with DED.
Phase I: Conceptualization and Questionnaire Development

After performing a preliminary literature search on dry eye questionnaires, I and other members of the research team commenced the initial phase of our research, gathering expert and patient opinion for the development of the UNC DEMS. This phase took place from August – November, 2013. For expert opinion, our research team consulted multiple ophthalmology attendings, residents, and medical students in the UNC Department of Ophthalmology. In addition, I and one other team member consulted a university biostatistician (Ph.D.) and a residential expert in survey and instrument development (Ph.D.). The research team presented the basic concept of developing a simplified dry eye scale that could accurately report both patient symptoms and the effect of those symptoms on quality of life to our contributing experts. We then asked for feedback in three areas: the feasibility of the scale, recommendations on what to include in the questionnaire, and finally the clinical appeal of the questionnaire.

In addition to consulting experts, we also sought input from patients with DED. An ophthalmologist on the research team directly asked multiple patients with DED what their primary symptoms were and how those symptoms affected their daily life. The ophthalmologist also asked the patients to select a number on a scale of 1 to 10 that would best simultaneously describe their DED symptoms and the effect of DED on their overall quality of life (QOL).

We combined the data gathered from expert and patient opinion with data already acquired from our extensive literature search on DED questionnaires. A preliminary version of the UNC DEMS was then created to be administered in Phase II of the study (Figure 1).

Phase II: Cognitive Interviewing and Questionnaire Modification

After the initial questionnaire was developed, one other member of the research team and I, both of whom had been trained in cognitive interviewing, administered the UNC DEMS and the OSDI to 18 patients with DED and subsequently performed cognitive interviewing on those patients. This phase took place from December, 2012 – January, 2013. We selected a broad range of subjects in order to include an adequate representation of women and men,
many races, people of different ages, and people with different severity of DED. Patients were generally recruited in the clinic prior to their scheduled ophthalmology appointment.

After completing the UNC DEMS and the OSDI, patients were asked multiple questions by the interviewers about the UNC DEMS. Some examples of questions asked include the following:

- “What do you think the question is asking about?”
- “I asked you to use a 1 to 10 scale. Can you describe what you are thinking of when you think of a 1? [Pause for patient to answer] And what about the 10—what are you thinking of? [Pause for patient to answer] What about the middle? What are you thinking of when you think of the 5?”
- “People usually say the symptoms of dry eyes are pain, burning, grittiness, ‘feeling like something’s in your eye’, tearing, and sensitivity of light. I’d like to take each of these, and ask what they mean to you. First, let’s start with pain. How does pain from dry eyes feel to you?” [repeat question for the remaining five symptoms]
- “In the questionnaire, we asked about how your dry eye symptoms affected your daily life. What does daily life mean to you?”
- “When you picked a number on the scale, were you thinking more about the dry eye symptoms, the effect on your daily life, or both?”
- “Does this scale let you say how good or bad your eyes are feeling?”

We recorded patient responses to cognitive interviewing and used this patient input to guide the modification of the UNC DEMS. The first 7 subjects completed the initial UNC DEMS (Figure 1). The subsequent subjects received a modified version of the UNC DEMS. All patients were asked similar cognitive interviewing questions irrespective of which questionnaire they received. Subject responses ultimately guided the creation of the final version of the questionnaire (Figure 2).

**Statistical Analysis:**

Pearson’s correlation coefficient was used to assess for the degree of correlation between subjects’ UNC DEMS scores and OSDI scores. I calculated two Pearson correlation coefficients. The first correlation compared the scores of all 18 subjects who had completed the OSDI and any version of the UNC DEMS. The second correlation compared the OSDI and UNC DEMS scores of the last 10 subjects who had completed the finalized version of the UNC DEMS.
RESULTS

Phase I:

Our initial literature search provided us examples of symptoms and disease effects on QOL to ask about in our questionnaire. Consulting experts provided feedback that developing a scale that measured DED symptoms and the effect of DED on QOL was feasible and had strong clinic appeal, as it could be used not only to monitor patient disease but also to educate patients on the management of their disease. In addition, experts provided recommendations of what to include in the scale. Although most symptoms in our scale came from our literature search, several experts noted that some patients may not understand the phrase “foreign body sensation” (a term used by ophthalmologists but not, most of the time, by patients); therefore, “feeling like something’s in your eye” was used in its place. For similar reasons, the phrase “daily life” was used to represent “quality of life.”

Patients consulted in Phase I confirmed our selection of dry eye symptoms and examples of daily life to be included in the scale. Patients also had no difficulty in selecting a number on a scale of 1-10 to describe both their symptoms and the effect of those symptoms on their QOL. Combining the information from our literature search with data gathered from expert and patient consultation, we created an initial version of the UNC DEMS (Figure 1) to be used in Phase II of our study.

Phase II:

Of 19 patients recruited, 18 agreed to participate in our study. Basic demographic information of the patients interviewed in Phase II is provided in Table 1. In general, patient responses from the cognitive interviewing process indicated that patients understood and liked the new UNC DEMS questionnaire. Responses from the first seven patients interviewed, however, also indicated that patients were selecting a number based on the examples of daily life provided in the tags underneath the number scale rather than based on symptom severity and overall effect on quality of life. Most patients stated that they were thinking about both their
dry eye symptoms and the effect on their daily life when answering the question; upon further probing, however, patients indicated that they were selecting their number score based on the examples of daily life provided in the tags underneath the numbers on the scale. This method of number selection resulted in a clustering of scores around the middle of the scale, as this is where the initial questionnaire started listing examples of effects on daily life. This subject feedback convinced us to move the examples of daily life from the tags underneath the numbers to the main text of the questionnaire.

Other modifications of the scale were more minor in nature but still important. For example, several patients thought that the term “severe” was more appropriate only for a score of 9 or 10 on the scale rather than a score of 7 or 8. Thus, we changed the term describing symptom severity in the 7-8 tag from “severe” to “very bothersome.” Some patients had also mentioned hobbies as an example of daily life affected by DED; therefore, we added the phrase “doing things you enjoy” as an example of daily life.

After we completed these modifications, we gave the modified UNC DEMS to 11 more patients, whom we subsequently interviewed (Note: Patient 8 was given a scale that included only some of the modifications listed above). Although minor grammar corrections were made following Patient 11’s interview, Patients 9-18 received essentially the same final version of the scale (Figure 2). Subject interview responses indicated these latter patients selected their UNC DEMS number scores based on symptom severity and the overall effect of DED on their quality of life, as was our initial intention for the scale. In addition, when asked “Do you feel that the term ‘very bothersome’ matches a 7-8 on the scale?”, patients responded affirmatively. Subjects also approved of the inclusion of “doing things you enjoy” as one of the examples of daily life.

After all 18 patients were interviewed, the research team added one supplemental question to the UNC DEMS. Underneath the scale, we added “Is there anything else you would like your doctor to know about your eyes?” followed by a blank space (Figure 3). The reason for this additional question was that, during the cognitive interviewing process, one patient wrote
additional information about his dry eye symptoms directly onto the UNC DEMS questionnaire. Another patient indicated that he liked the UNC DEMS questionnaire but wanted to be able to discuss the details of his DED with his ophthalmologist. Therefore, this supplemental question was placed underneath the scale of the UNC DEMS to serve as a springboard for discussion with the physician about a patient’s DED.

Statistical Analysis:

Questionnaire scores for all 18 patients showed a high degree of correlation between the UNC DEMS and OSDI scores (Pearson’s correlation coefficient = 0.744, 95% CI = 0.426, 0.899, p-value < 0.001). The UNC DEMS and OSDI scores for the last 10 patients, who received the final version of the UNC DEMS, produced an even slightly higher degree of correlation (Pearson’s correlation coefficient = 0.789, CI = 0.317, 0.948, p-value = 0.007).

DISCUSSION

The early phases of our research indicate that the UNC DEMS will help meet the growing need for valid, reliable, and low-burden patient-reported measures for DED. As it was developed with input from both DED experts and patients, the UNC DEMS is simultaneously a clinically based and patient-centered questionnaire. Although some may critique the UNC DEMS for being essentially a single-item visual analog scale (VAS), a recent study found that the single-item EuroQoL VAS was better able to distinguish between different severity levels (e.g. mild, moderate, severe) of DED than was any component of the Medical Outcomes Study Short Form 36 Health Survey (a general health status QOL measure). As the UNC DEMS combines a VAS with specific dry eye symptoms and effects on QOL, one would expect it to be even more discriminative than the EuroQoL VAS. Our questionnaire’s high correlation with OSDI scores support this claim.

Another potential critique of our instrument development would be that the UNC DEMS offers no new advantages over the IDEEL and OSDI questionnaires. Although both of these latter instruments are valid and reliable measures of DED’s effects on a patient’s daily living,
both are also multi-item questionnaires that may be burdensome for patients to complete and that consume valuable clinic time to score. The UNC DEMS offers clinicians a single-item questionnaire which, based on our cognitive interviews, is easily read, understood, and completed by patients. Even though scores on the UNC DEMS and OSDI were highly correlated, the UNC DEMS is not a replacement for either the OSDI or IDEEL. Both of these questionnaires are and will likely remain valuable patient-reported measures in the clinic and in clinical trials. The UNC DEMS instead offers an alternative or supplemental questionnaire for clinical trials and in particular for clinical practice. It may prove particularly useful as an efficient disease-monitoring tool when time is limited in the clinic.

Current therapies for DED include artificial tears, anti-inflammatory treatments (including corticosteroids and cyclosporine ophthalmic emulsion 0.05% [Restasis: Allergan Inc.]), punctal plugs, antibiotics, and other etiology-specific treatments (e.g. lid hygiene and surgical procedures, among others). Although beneficial to some, DED therapies are of limited benefit to many patients—in particular patients with moderate-to-severe DED. As dry eye symptom improvement in response to treatment does not correlate strongly with clinical dry eye tests, it is imperative that valid, efficient patient-reported measures be developed and used to monitor disease treatment and management.

Our research indicates the UNC DEMS is a valid, efficient patient-reported measure that could be used for such purposes.

In addition to being a potential tool for monitoring treatment, the UNC DEMS offers hope for better educating patients about the chronic nature of their disease. DED is a chronic disease that not only reduces QOL but also harms individuals’ moods and confidence in moderate-to-severe disease. The UNC DEMS is specifically designed as a single-item questionnaire physicians can use to educate their patients on the chronic nature of their disease as well as the treatment goals of DED—goals that are palliative rather than curative. The final phase of our research (pilot and feasibility testing) is specifically designed to assess the UNC DEMS’s usability in this educational context. Our hope is that using the UNC DEMS as not only a
disease-monitoring tool but also as a patient-education tool will provide patients a better understanding of their disease and subsequently lead to increased confidence in their ability to manage their dry eye.

One final advantage of the UNC DEMS is that it includes a time frame. Many dry eye surveys neglect to include any type of time frame, which in turn could lead to a wide variation in patient responses depending on whether they are trying to report current symptoms, average symptoms, or most severe symptoms. This lack of a time reference could also help explain the discrepancies between patient-reported symptoms and clinical findings. The one week time frame in the UNC DEMS provides a reference point that allows patients to account for the fluctuations in their symptom severity while also covering a small enough period of time that patients can easily recall their symptoms and the overall effect on their QOL.

Our study is not without limitations. First, our sample consisted of only 18 patients. While this size could certainly limit the value of our statistical analysis, this number of patients is considered more than adequate for cognitive interviewing. In addition, we included a wide variety of patients representative of multiple races and both sexes in order to ensure utility of this instrument in a diverse population. Since we did use such a small sample size for our statistical analysis, we are currently performing further testing on the UNC DEMS with a much larger sample size to ascertain the characteristics of the UNC DEMS’s validity and reliability. One other limitation of our study is that it was performed solely at the UNC Ophthalmology Clinic. Although the patient population at UNC is very diverse, our institution-specific research does potentially limit the generalizability of our questionnaire. Once the UNC DEMS has undergone further validity testing at UNC, other researchers should perform trials at their respective institutions to test for broader generalizability of this tool.

Continued research on the UNC DEMs is ongoing. Currently, a mid-sized validity and repeatability trial is being performed at UNC. This will be followed by a pilot and feasibility trial testing whether the UNC DEMS is a useful tool for educating patients about the chronic nature
and management of DED. Despite the need for this future research, our initial study results show that the UNC DEMS is a valid patient-reported measure of both symptoms and QOL in DED. Our hope is that this tool will assist physicians in the monitoring and management of dry eye patients in their time-limited clinical settings.
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<th>Patient Demographics</th>
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<td><strong>Sex (%)</strong></td>
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<tr>
<td>Male (50%)</td>
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<tr>
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<tr>
<td><strong>Mean Age in Years (range)</strong></td>
</tr>
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<td>65 (47 – 90)</td>
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<tr>
<td><strong>Race (%)</strong></td>
</tr>
<tr>
<td>Caucasian (72%)</td>
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<tr>
<td>African-American (17%)</td>
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<td>Other (11%)</td>
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Dry Eye Symptom Severity Scale

Instruction:
Your dry eye symptoms may include: pain, burning, tearing, grittiness, "feeling like something is in your eye", and/or sensitivity to light. We want to know not just your dry eye symptoms, but also how your symptoms have affected your daily life and the things you want to do.

Please circle the number (1-10) that best describes your dry eye symptoms and the overall effect on your daily life over the past week.

[1 - 2] My symptoms are *not* a problem. My dry eye *does* not affect my daily life at all.

[3 - 4] My symptoms are *mild* and easily tolerable. My dry eye *hardly* affected my daily life—it did not interfere with what I want to do.

[5 - 6] My symptoms are *moderately* bothersome. My dry eye *sometimes* affected my daily life and I sometimes have difficulty doing activities like: reading or watching TV.

[7 - 8] My symptoms are *severe*. My dry eye *often* affected my daily life and I have difficulty doing activities like: working on a computer or focusing.

[9 - 10] My symptoms are *very severe* and I need immediate medical care. My dry eye has *greatly* worsened my daily life and I am unable to do activities like: driving.
Figure 2: Modified UNC DEMS

UNC Dry Eye Management Scale

**Instruction:**
Your dry eye symptoms may include: *pain, burning, tearing, grittiness, “feeling like something is in your eye”*, and/or sensitivity to light.

We want to know how bad your dry eye symptoms are and how they affect your daily life and the things you want to do like reading, driving, working with a computer, watching TV, or doing things you enjoy.

Please circle the number (1-10) that **best describes** your dry eye symptoms and how they affect your daily life **over the past week**.

![UNC Dry Eye Management Scale](image_url)
We want to know how bad your dry eye symptoms are and how they affect your daily life and the things you want to do like reading, driving, working with a computer, watching TV, or doing things you enjoy.

Please circle the number (1-10) that best describes your dry eye symptoms and how they affect your daily life over the past week.

Is there anything else you would like your doctor to know about your eyes?
REFERENCES


INTRODUCTION

The evidence that dry eye disease (DED) can greatly diminish individuals’ quality of life (QOL) is steadily increasing.\(^1\)\(^{-3}\) Recent utility assessments of DED show that moderate-to-severe dry eye can cause a similar decrease in QOL as dialysis, severe angina, and disabling hip fractures.\(^4\)\(^{-5}\) Several clinical dry eye tests exist to help monitor the severity of DED. For example, fluorescein staining can help highlight damage to the corneal epithelium caused by persistent dry eye, and tear break-up time can be used to monitor tear film stability. Multiple other tests exist such as lissamine green staining, Schirmer test type 1, Schirmer test type 2, and many other clinical measures.\(^1\)\(^{,6\text{-}7}\) Unfortunately, these tests correlate extremely poorly with patient symptoms and QOL measures in dry eye patients.\(^1\) This weak correlation makes assessing QOL through patient-reported questionnaires even more important.\(^8\)\(^{-9}\) In addition, the Federal Drug Administration (FDA) has increased their emphasis on properly developing and using patient reported outcomes (PROs), such as QOL measures, in clinical drug trials to determine treatment efficacy.\(^10\) Due to this increased emphasis on proper PRO development, as part of the instrument development of the UNC Dry Eye Management Scale (DEMS), a novel PRO questionnaire for DED, I performed a systematic review to determine what other dry eye questionnaires include QOL measures in their assessment of DED.

METHODS

The main objective of this systematic review was to determine which validated, reliable dry eye questionnaires include QOL measures in their assessment of PROs. To answer this question, I performed a PubMed search on March 9, 2013, using the following Medical Subject Headings (MeSH) phrases (results provided in parentheses):

- “dry eye questionnaire AND quality of life” (107 articles)
• “dry eye scale AND quality of life” (31 articles)
• “dry eye AND quality of life assessment” (46 articles)
• “dry eye AND quality of life measures” (42 articles)
• “dry eye AND quality of life measurement” (15 articles)

These 241 articles were subsequently pulled into a research database for review. Of these articles, 101 were duplicates and removed from the database. The remaining 140 articles underwent full title and abstract review. For articles to be included in the final analysis, the articles had to assess dry eye questionnaires that included QOL measures, be written in English, and be published prior to March 9, 2013. In addition, the questionnaires assessed by these articles had to be written in English and not limited to a specific autoimmune disorder (e.g. Grave’s Disease). Of the 140 articles undergoing abstract review, 122 articles were eliminated as they did not meet eligibility criteria.

The remaining 18 articles underwent full-text review. During this phase, I eliminated one article due to its focus solely on an autoimmune-specific questionnaire. I eliminated one other article because it did not discuss any dry eye questionnaires. The remaining 16 articles provided the basis for this review. The references of these 16 articles were also examined to uncover more background information on the validity and reliability of specific dry eye questionnaires when necessary—a process that led to four more articles being used for this review. Finally, if the actual questionnaires were not provided in the articles, they were procured online or from the UNC Department of Ophthalmology when possible.

RESULTS

Based on this review, two validated, reliable dry eye questionnaires that including QOL measures are currently available for clinic use: the Ocular Surface Disease Index (OSDI) and the Impact of Dry Eye on Everyday Life questionnaire (IDEEL). Other dry eye
questionnaires also assess some degree of QOL but have either not been tested for validity and reliability or are limited in what QOL measures they assess.

The OSDI

Description: The OSDI is a 12-item questionnaire that assesses both dry eye symptoms and their effects on vision-related functioning over the past week. It contains 3 subsections including vision-related function, ocular symptoms, and environmental triggers. Patients are asked about the frequency of various symptoms and difficulty with vision-related activities and respond on a 0-4 scale that ranges from “none of the time” to “all of the time.” The final score is calculated by multiplying the sum of all the scores by 25 and then dividing the total by the number of questions answered. Scores range from 0 to 100 with 0-12 representing normal dry eye disease (DED), 13-22 mild DED, 23-32 moderate DED, and >33 severe DED.

Validity and Reliability Testing: The OSDI has undergone substantial validity and reliability testing since its initial development. The OSDI as a whole and its three subscales individually are all internally consistent and display good-to-excellent test-retest reliability. Although the questionnaire is only weakly correlated with clinical dry eye tests, it is strongly correlated with several other dry eye questionnaires and has moderate correlations with artificial tear usage. The scale is capable of accurately discriminating between normal, mild-to-moderate, and severe dry eye disease. In addition, a minimal clinically important difference (MCID) has been determined for mild-to-moderate disease (4.5 – 7.3) and severe disease (7.3 – 13.4).

QOL Measures: The main QOL measures in the OSDI are in its vision-related function subscale. This subscale consists of 6 questions which assess the frequency of problems with vision and vision-related activities such as reading, watching TV, driving, and using a computer or ATM-machine. These 6 questions are included in the overall OSDI score and can be computed into their own vision-related function subscale score as well.

Limitations: One limitation of the OSDI is that it only includes some dry eye symptoms such as grittiness, sensitivity to light, and pain but does not include other symptoms such as foreign
body sensation and tearing. It also only discusses some of DED’s effects on vision-related functioning; therefore, it may not capture the entire effect of DED on a patient’s daily living. In addition, OSDI responses are limited to measures of frequency (rather than frequency and severity). A second limitation of the OSDI is the effort required to complete and score the scale, which may consume valuable clinic time in a practice.

Overall Utility: Overall, the OSDI is a valid, reliable dry eye questionnaire that at least partially captures DED’s effects on QOL. Even with its limitations, the OSDI has proven to be a valuable patient-reported outcome (PRO) measure in clinical trials as well as ophthalmology clinics.

The IDEEL

Description: The IDEEL is a 3-module questionnaire with 57 questions that assesses dry eye symptoms, DED’s effect on QOL, and treatment satisfaction over the past 2 weeks. The three modules consist of six scales which are outlined below:

- Dry Eye Impact on Daily Life: Activity Limitations, Work Limitations, and Emotional Impact
- Dry Eye Treatment Satisfaction: Satisfaction with Treatment and Treatment-Related Inconvenience
- Dry Eye Symptom(Related) Bother (which is its own scale)

Each module is scored from 0 – 100. Higher scores on the Impact on Daily Life module and Treatment Satisfaction module indicate better QOL and higher treatment satisfaction. Higher scores on the Symptom Bother module indicate more bothersome dry eye symptoms. For the Symptom Bother module, 40.0 (± 7.5) is the average score of patients with mild DED, 50.6 (± 11.0) for patients with moderate DED, and 64.3 (± 8.0) for patients with severe DED.

Validity and Reliability: The IDEEL meets the new FDA PRO instrument development guidelines and has undergone significant validity and reliability testing. In addition, content validity has been confirmed by strong evidence of item saturation (i.e. multiple interviews confirmed that the questionnaire included the relevant questions needed to achieve its assessment objective).
The questionnaire is internally consistent and has good test-retest reliability. The IDEEL weakly correlates with clinical dry eye tests and generic QOL questionnaires (Short Form-36 [SF-36] and EuroQoL-5D [EQ-5D]). In addition, its modules have mild-to-strong correlations with the Dry Eye Questionnaire (DEQ). The Symptom Bother and Impact on Daily Life modules are able to discriminate between mild, moderate, and severe DED. In addition, a MCID of 12 points has been determined for the Symptom Bother module.

**QOL Measures:** The IDEEL has an entire module dedicated to assessing DED’s effects on a patient’s QOL. The Impact on Daily Life module consists of 31 questions that assess DED’s effects on a patient’s emotions (e.g. irritability, sadness), activities (e.g. driving, doing close work), and work (e.g. difficulty concentrating, feeling distracted). These 31 questions ultimately produce a score for the entire Impact of Daily Life module. Finally, the IDEEL’s Impact on Daily Life and Symptom Bother modules are better able to discriminate between mild, moderate, and severe DED than other QOL questionnaires such as the SF-36 and EQ-5D.

**Limitations:** The primary limitation of the IDEEL is that it takes approximately 30 minutes to complete the entire questionnaire. This limitation is partially offset by the fact that individual modules can be used in practice rather than the entire questionnaire. One final limitation of the IDEEL is that it must be purchased for use.

**Overall Utility:** The IDEEL is a valid, reliable dry eye questionnaire that does an excellent job of assessing DED’s effects on QOL. It contains the most QOL measures of any current dry eye questionnaire. Its overall utility is somewhat uncertain due to its recent development and thus limited use in recent clinical trials, but it holds promise at being an important PRO questionnaire for measuring QOL in patients with DED. In addition to cost, the major limitation of this questionnaire’s use in practice may be that it is time-consuming. This limitation, however, may not be as restricting in clinical trials.
Other Questionnaires:

Although the OSDI and IDEEL are the only two disease-specific, validated, reliable questionnaires that assess DED’s effect on QOL, other questionnaires have been used to assess QOL measures in patients with DED. The 25-item National Eye Institute Visual Function Questionnaire (NEI-VFQ-25) assesses the effect of various eye diseases on QOL.\(^9,25\) It is not disease-specific but has been tested in dry eye patients and displays a modest to strong correlation with the OSDI.\(^4,5,8,9,16\) Of particular note, the NEI-VFQ-25’s ocular pain subscale had the strongest overall correlation with the OSDI leading some researchers to suggest that patients with low ocular pain scores on the NEI-VFQ-25 should undergo further dry eye testing.\(^16,17\) Limitations of the NEI-VFQ-25 for assessing QOL in dry eye patients is that it is not disease-specific, needs further validity and reliability testing in a dry eye population, lacks a specified recall period, and requires 10-minutes to administer the questionnaire.\(^8,9\)

The original DEQ and the contact lens DEQ (CLDEQ: includes extra questions for contact-lens wearers) include questions about DED symptoms effecting daily activities; but overall, both questionnaires (as well as subsequent variations of these questionnaires) include very few QOL measures and need reliability testing.\(^8,22,26\) The Texas Eye Research and Technology Center Dry Eye Questionnaire (TERTC-DEQ) is a 33-item questionnaire based on the original DEQ that adds several components to the original DEQ, including two questions on the disease-effect on QOL.\(^8,21\) The questionnaire has undergone some validity testing and can discriminate between normal patients and patients with moderate dry eye. Limitations of the questionnaire for measuring QOL in dry eye patients include the need for further test-retest reliability testing. In addition, only a small portion of the questionnaire is dedicated to QOL measures.\(^21\) Thus, all three of these questionnaires are fairly limited in their ability to assess DED’s effect on QOL.

Several other dry eye questionnaires reported in the literature include QOL measures. First, an 11-Question Dry Eye Syndrome Questionnaire including DED-specific QOL questions
was used among participants in the Women’s Health Study and Physicians’ Health Study to determine the effects of dry eye on daily living. Second, a Single Item Score Dry Eye Questionnaire (SIDEQ) that attempts to quantify dryness-caused discomfort was used in a recent study to determine whether or not dry eye patients were currently symptomatic; this questionnaire showed strong correlations with the OSDI as well as some clinical tests. Both of these questionnaires may assess some QOL measures in dry eye patients but are poorly described in the literature and need to undergo substantially more validity and reliability testing before being recommended for clinical use.

One final DED questionnaire that measures QOL is the Ocular Surface Disease questionnaire (OSD). It did not meet the criteria for this review because it was developed and tested in the French language. It includes four modules one of which is quality of life (OSD-QoL). The OSD-QoL module has been clinically validated and displays low-to-excellent internal consistency and test-retest reliability. Its main limitations include the need for further validity and reliability testing of the other modules (medical management/history, symptoms, and treatment satisfaction), lack of data about testing and use in the English language, and no recall period provided in the questionnaire. Once these limitations are addressed, the OSD may serve as valuable tool in the clinic.

CONCLUSION:

This review provides a brief analysis of the dry eye questionnaires currently available to assess vision-related QOL in patients with DED and should assist clinicians and researchers alike in determining which questionnaire is best for their individual situation such as a clinical practice or a clinical trial. To summarize, there are two validated, reliable disease-specific questionnaires that assess QOL measures in patients with DED: the OSDI and IDEEL. The IDEEL underwent an extensive development process, contains the most QOL measures of these two questionnaires, and may offer the best assessment of DED’s effect on QOL for clinical trials. The OSDI, however, can be completed much more quickly than the IDEEL, is free
for use, and thus may be the more convenient option for use in the clinic. Other questionnaires (e.g. NEI-VFQ-25, TERTC-DEQ, etc.) can be used to assess QOL in dry eye patients but are extremely limited in this assessment due to a lack of QOL measures or a lack of validity and reliability testing. This review highlights the need for further testing of these dry eye questionnaires.

Finally, multiple studies continue to show DED’s deleterious effects on patients’ QOL, and PRO questionnaires remain one of the best ways to measure this disease-effect on a patient’s daily living. This review emphasizes the importance of including such QOL measures in future PRO questionnaires for DED. An increased emphasis on QOL in dry eye questionnaires will not only provide valuable outcome data for clinical trials but will also assist in the clinical treatment and management of DED.
REFERENCES


25. RAND. National eye institute visual functioning questionnaire - 25 (VFQ - 25).

26. Dry eye questionnaire.
Cognitive Interviewing Protocol Summary

In brief, I and another medical student examined the clinic schedule of two ophthalmologists here at the UNC ophthalmology clinic for potential patients with dry eye disease from December, 2012, to January, 2013. We subsequently recruited these patients in clinic, explained the research study, answered any questions, and then had the patients sign informed consent documents. We then administered both the UNC DEMS and OSDI to the participants. After they had completed the questionnaires, we then asked the patients multiple questions about the UNC DEMS using the process of cognitive interviewing. The basic template for our cognitive interviews is provided on the next page. The interviewer asked each patient all the questions in this template but would sometimes ask additional questions to clarify a patient response or to gather more information about a patient’s opinion of the questionnaires. On average, the interviews lasted 15-20 minutes. The project was approved by UNC’s IRB (study number 12-2089).
Cognitive Interviewing Template

Did patient take both the DESSS scale and the validated questionnaire before this interview? YES NO If not please explain:
_________________________________________________________________________

Scripted Introduction: Hello, my name is __________, and I am a medical student helping to develop a new questionnaire for dry eyes. If you don’t mind, I’m going to ask you a few questions about that questionnaire [show them the questionnaire they just completed]. I did not develop this questionnaire, and you are not going to hurt my feelings at all with anything you say about it. We want to make this questionnaire the best it can be for helping people like you, so feel free to say anything that comes to mind when answering my questions. Do you have any questions? Let’s get started.

1. What do you think the question is asking about?

2. I asked you to use a 1 to 10 scale.
   a. Can you describe what you are thinking of when you think of a 1?
   b. And what about the 10—what are you thinking of?
   c. What about the middle? What are you thinking of when you think of the 5?

3. People usually say the symptoms of dry eyes are pain, burning, grittiness, foreign body sensation/“feeling like something’s in your eye”, tearing, and sensitivity of light. I’d like to take each of these, and ask what they mean to you?
   a. First, let’s start with pain. How does pain from dry eyes feel to you?
   b. Next, let’s talk about burning. How does burning from dry eyes feel to you?
   c. Let’s move on to grittiness. How does grittiness from dry eyes feel to you?
d. Ok, now foreign body sensation/“feeling like something’s in your eye”. What does ___(either term listed above)___ caused by dry eyes feel like to you?

e. How about tearing? How does tearing caused by dry eyes feel to you?

f. Now our last symptom—sensitivity to light. How does sensitivity to light caused by dry eyes feel to you?

g. Do you experience any other symptoms from dry eyes?____________________

   How does __(previous answer)__ feel to you?

4. In the questionnaire, we asked about how your dry eye symptoms affected your daily life. What does daily life mean to you?

   Follow-up: Can you give me an example of daily life? [NOTE: Interviewer, do NOT provide them an example; if they ask for one, say “anything that came to mind when I asked the question”]

5. When you picked a number on the scale, were you thinking more about the dry eye symptoms, the effect on your daily life, or both?

   Follow-up: When you say __(previous answer)__ , tell me what comes to mind.

6. How do your dry eye symptoms affect your daily life?

7. We gave examples to give you an idea of what the numbers on the scale might mean [can point out one or two examples if necessary]. Do you think the examples we gave match the numbers on the scale?
Follow-up: Can you think of any other examples for the numbers?

[NOTE: This question was modified for patients 8-18 due to us removing the examples from specific numbers on the scale and placing the examples at the top of the page. Patients 8-18 were asked the following question: “We gave you some examples of daily living. Are there any other examples you can think of that we should include in this questionnaire?”]

8. We used the words “mild” “moderately” and “severe” to describe your dry eye symptoms.
   a. Do you feel the word “mild” matches a 3-4 on the scale?
   b. Do you feel the word “moderately” matches a 5-6 on the scale?
   c. Do you feel the word “severe” matches a 7-8 on the scale?

[NOTE: For the latter patients in this study, question 8c was modified to read as follows:
   “Do you feel the word ‘very bothersome’ matches a 7-8 on the scale?”]

9. Similarly, we used the words “hardly” “sometimes” and “frequently” to describe how the symptoms may have affected your daily life.
   a. When the scale says “hardly affects your daily life” does that match a 3-4 on the scale?
   b. When the scale says “sometimes affects your daily life” does that match a 5-6 on the scale?
c. When the scale says “frequently affects your daily life” does that match a 7-8 on the scale?

10. Does this scale let you say how good or bad your eyes are feeling?

11. How easy or hard is it to remember how your dry eyes affected you in the past week?

   Follow-up: How do you remember this?

12. Did the 10 point scale let you say enough about what you are feeling that you didn’t need to answer the other questions we gave you [show them OSDI] OR was answering the other questions helpful?

13. Is there anything else we’ve forgotten or that you think we need to know to make this a good scale in describing your dry eye symptoms and the effect on your daily life?