The National Eye Institute Visual Function Questionnaire: Experience of the ONTT

Stephen R. Cole, Roy W. Beck, Pamela S. Moke, Robin L. Gal, Danielle T. Long, and the Optic Neuritis Study Group

Purpose. To describe the health-related quality of life, measured with the National Eye Institute Visual Function Questionnaire (NEI–VFQ), of patients several years after the onset of optic neuritis, according to their neurologic and visual status; to assess the relationship between the NEI–VFQ subscales and clinical measures of visual function; and to assess the internal consistency reliability of the NEI–VFQ subscales.

Methods. The NEI–VFQ was administered to 244 patients 5 to 8 years after treatment for an episode of acute optic neuritis as part of the Optic Neuritis Treatment Trial. Visual acuity, visual field, contrast sensitivity, and color vision were measured at the same time as questionnaire completion.

Results. The NEI–VFQ scores generally were lower than those reported for a disease-free group. Reported dysfunction was greater when multiple sclerosis was present and when visual acuity was abnormal, supporting the construct validity of the NEI–VFQ. Rank correlations between the NEI–VFQ subscales and clinical measures of visual function were moderate at best. Internal consistency reliability was generally high for most of the NEI–VFQ subscales.

Conclusions. These findings add support to the use of the NEI–VFQ as a valuable measure of self-reported visual impairment. (*Invest Ophthalmol Vis Sci.* 2000;41:1017–1021)

Optic neuritis is an acute inflammatory disease of the optic nerve, most commonly produced by demyelination. It usually occurs either as a solitary neurologic finding (referred to as isolated optic neuritis) or in a patient with known multiple sclerosis (MS). In the former circumstance, it often represents a "forme fruste" of MS.[1] In most cases, optic neuritis attacks are unilateral. Vision typically begins to spontaneously improve within days to weeks, and recovery is nearly complete within 2 to 3 months. However, even when visual acuity recovers to 20/20, many patients have lasting symptoms of visual impairment, and abnormalities can be frequently demonstrated in contrast sensitivity, color vision, stereopsis, light-brightness sense, the visual field, afferent pupillary reaction, optic disc appearance, and the visual evoked potential.[2–4] Recurrent attacks of optic neuritis either in the same eye or the fellow eye occur within 5 years in approximately 30% of patients; the rate is higher in those with MS (approximately 50%) than in those without MS (approximately 25%).[5]

The Optic Neuritis Treatment Trial (ONTT), a multicenter randomized trial funded by the National Eye Institute, found that (1) treatment with intravenous corticosteroids can accelerate visual recovery but does not have an effect on the degree of permanent visual loss and (2) treatment with oral prednisone does not improve vision and may be associated with an increased risk of recurrence.[5,6]

From the Jaeb Center for Health Research, Tampa, Florida.

Supported by cooperative agreement EY05435 from the National Eye Institutes of the National Institutes of Health (Bethesda, Maryland).

Submitted for publication April 27, 1999; revised August 27 and October 21, 1999; accepted October 27, 1999.

Commercial relationships policy: N.

Corresponding author: Roy W. Beck, Jaeb Center for Health Research, Suite 9, 3010 E. 138th Avenue, Tampa, FL 33613. rbeck@jaeb.org

Measurement of health-related quality of life (HRQL) has become recognized as an important adjunct to clinical outcome measures in clinical trials. HRQL is the subjective self-assessment of one's health status, often partitioned into several relevant domains, such as physical functioning, emotional well-being, and social relations. The National Eye Institute supported the development of the Visual Functioning Questionnaire (NEI–VFQ), an instrument to assess self-reported visual impairment in studies of vision. Prior studies have reported results from the NEI–VFQ among patients with age-related cataracts, age-related macular degeneration, diabetic retinopathy, primary open-angle glaucoma, cytomegalovirus retinitis, low vision from any cause,[7] and glaucoma.[8,9]

As part of the ONTT, we administered the NEI–VFQ to a subset of patients 5 to 8 years after study entry. Herein we report the following: (1) a description of HRQL, measured with the NEI–VFQ, of patients several years after optic neuritis, according to their neurologic and visual status; (2) the relationship between the NEI–VFQ subscales and clinical measures of visual function; and (3) the internal consistency reliability of the NEI–VFQ subscales.

Methods

The protocol, baseline characteristics of patients, and ONTT treatment trial results have been reported previously.[3,5,10–13] Briefly, 457 patients between 18 and 46 years of age with acute unilateral optic neuritis and no indication of a causal systemic disease other than MS were enrolled. The primary visual outcome from treatment was assessed after 6 months. Patients continued to be followed yearly to assess visual and neurologic courses. The study protocol was approved by the Institutional Review Board at each clinical center. Written informed consent was obtained from each patient, in adherence with the Declaration of Helsinki.

Vision tests, all performed with correction of refractive error from a standardized refraction protocol, included the following: (1) visual acuity with a retro-illuminated ETDRS chart, (2) contrast sensitivity with the Pelli–Robson chart, (3) color vision with the Farnsworth Munsell 100-hue test, and (4) visual field with the Humphrey Field Analyzer, program 30-2. The normal ranges for visual acuity (logMar value < 0.0 (better than 20/20) and contrast sensitivity ($\geq$line 15) were based on normative data collected by the ONTT clinical centers on subjects in the age range of the ONTT patients[14] for color vision (error score ≤ 110) based on published data,[15] and for visual field mean deviation (≥ -3.00) based on unpublished normative data collected by the ONTT Visual Field Reading Center at the University of California, Davis (Johnson C, unpublished observations, January 1991). Each patient was classified as having zero, one, or two eyes abnormal with respect to visual acuity.

A diagnosis of clinically definite MS (CDMS) was made when a patient reported new neurologic symptoms consistent with demyelination, other than recurrent optic neuritis, lasting more than 24 hours that were confirmed by the presence of a new neurologic abnormality on examination.[16] Neurologic disability was assessed using the Expanded Disability Status Scale (EDSS).[17] Each patient was classified as follows: no CDMS, CDMS with EDSS < 3, or CDMS with EDSS ≥ 3.

Between April 1996 and March 1997 (5–8 years from study entry), the 51-item field-test version of the NEI–VFQ was included as part of the testing at the annual examination of 244 patients who had a study visit during this 1-year period at one of the study clinical centers. The major reason for noninclusion of patients (for 167 [78%] of the 213 nonincluded patients) was that they did not have a visit at a study clinic in the time window in which the NEI–VFQ was administered: 13 of the patients had moved and had ongoing follow-up by a nonstudy ophthalmologist, 50 patients discontinued follow-up before the inclusion of the NEI–VFQ, and 104 were still in follow-up but did not have a visit during the 12 months it was administered (visit window for annual visits spanned 16 months). Forty-six (22%) patients had an examination at a study clinic during the time window of the NEI–VFQ but did not complete the NEI–VFQ; we did not collect data on whether the patient refused or the clinic neglected to give the questionnaire to the patient to complete. The 213 patients who were not included were similar to the 244 who were included in gender (75% versus 79% female, $P = 0.31$) but were slightly younger in age at the time of entry into ONTT (mean 31 ± 6 versus 33 ± 7, $P < 0.01$) and were slightly less often white (82% versus 88%, $P = 0.05$).

To ease the implementation of the NEI–VFQ in the study, the questionnaire was self-administered. Clinic staff described the questionnaire and how it was to be completed. This was reiterated in written instructions, which preceded the questions.

Subscales, scored 0 to 100 (with 100 indicating highest function), were generated for overall health, overall vision, difficulty with near vision activities, difficulty with distance vision activities, limitations in social functioning due to vision, role limitations due to vision, dependency due to vision, mental health symptoms due to vision, future expectations for vision, driving difficulties, limitations with peripheral and color vision, and pain or discomfort in or around eyes. For analysis, when one or more items from a subscale were missing, the subscale was considered missing. Analyses using all available data (i.e., a subscale score was generated when the subject responded to one or more items from the subscale) provided similar results (data not shown). In addition to the 51-item field test version of the NEI–VFQ, we calculated scores for the 25-item version and present limited results using this abbreviated version.

Table 1. Characteristics of Subjects at Time of Completion of NEI–VFQ ($N = 244$)

Characteristic	Subjects
Age	40 (7)
Female	192 (79)
White	215 (88)
Occupation*	
Professional/administrative	109 (50)
Nonprofessional	67 (31)
Laborer	41 (19)
Clinically definite multiple sclerosis (CDMS)	110 (45)
EDSS (for 110 patients with CDMS)	
0–2.5	94 (86)
3–5.5	11 (10)
$\geq$6.0	5 (5)
Recurrence of optic neuritis in either eye since study entry	66 (27)

Age is in years, mean ($\pm$ SD). Values are *n* (%).

* 27 missing observations for occupation; nonprofessional includes clerical workers, sales workers, and students; laborer includes service workers, craftsmen, operatives, laborers, farmers, and farm laborers as defined per U.S. Census.

Statistical Methods

For each NEI–VFQ subscale, we computed a mean and SD, as well as level-specific mean values and standard deviations by gender, race group, occupation, and the 3-level ordered categorical variables for MS/neurologic disability and visual acuity in the two eyes. We assessed the mean differences in these ordered categorical variables by a test for trend, as well as using ANOVA with Dunnett's multiple comparisons test, which compares each successive level to the lowest.[18] Due to the skewed distributions for the clinical visual function measures, Spearman's rank correlation coefficient, r_s,[19] was used to assess the association of these measures with the NEI–VFQ subscales for the better eye. Internal consistency reliability was assessed with Cronbach's alpha (α)[20] for each multi-item subscale. All analyses were carried out using SAS version 6.12[21] on a UNIX platform.

Results

The 244 patients had an average age of 40 ($\pm$7) years at the time of completion of the NEI–VFQ; 79% were female and 88% were white. At the time of the completion of the NEI–VFQ, 110 of the 244 (45%) patients had been diagnosed as having CDMS. However, even when CDMS was present, neurologic disability was generally mild, with only 15% of the 110 patients with CDMS having an EDSS score > 2.5 (Table 1).

At the time of completion of the NEI–VFQ, most patients had good vision in both eyes (Table 2). Specifically, 61% had visual acuity of 20/20 or better in both eyes, whereas only 6% had visual acuity worse than 20/40 in one eye and only 3 (1%) patients had acuity worse than 20/40 in both eyes.

Table 2. Visual Function at Time of Completion of NEI–VFQ

Measure	Better Eye	Worse Eye
Visual acuity (N = 244)	−.14 (−.22, −.06) [16%]	−0.06 (−.14, .04) [39%]
Contrast sensitivity (N = 243)	15 (15, 16) [17%]	14 (13, 15) [58%]
Visual field (N = 225)	−.05 (−1.40, 1.01) [12%]	−1.41 (−3.92, −.02) [33%]
Color vision (N = 234)	55.00 (28.00, 87.00) [18%]	85.50 (46.00, 159.00) [37%]

Values are: median (quartiles) [% abnormal]. Visual acuity measured with a retro-illuminated ETDRS chart (normal range: logMar value <0.0, better than 20/20); contrast sensitivity measured with a Pelli–Robson chart (normal range ≥ line 15); visual field measured with the Humphrey Field Analyzer (normal range: mean deviation ≥−3.00); and color vision measured with the Farnsworth–Munsell 100-hue test (normal range: color vision error score ≤110).

NEI–VFQ Results

The NEI–VFQ subscale mean values did not differ notably by gender or race group (data not shown). However, those classified with occupations of "laborer" (see Table 1 footnote) reported lower mean values for several subscales: general health, 67 versus 73 (P = 0.05); general vision, 75 versus 80 (P = 0.05); ocular pain, 81 versus 88 ($P < 0.01$); near vision, 85 versus 92 ($P < 0.01$); distance vision, 83 versus 90 (P 0.02); mental health: 81 versus 87 ($P = 0.04$); role difficulties: 82 versus 92 ($P < 0.01$); and peripheral vision, 80 versus 91 ($P < 0.01$).

With the exception of the NEI–VFQ expectations subscale, scores among the recovered optic neuritis patients were generally lower than a disease-free comparison group (Table 3). This disease-free comparison group consisted of 75 women and 47 men with a mean age of 59 (±14) years who were seen for a screening dilated eye examination or correction of refractive error.[7] The majority of NEI–VFQ subscales showed more dysfunction with increased neurologic disability, with the majority of the probability values for trend < 0.01 (Table 4). For the majority of the subscales demonstrating a significant trend, the association was driven by the highest category of neurologic disability. This is demonstrated by the significant Dunnett's multiple comparison test (which compares each category to the lowest disability group, Table 4). Similar trends were observed between several NEI–VFQ subscales and the combined visual acuity variable, with the majority of the probability values for trend < 0.01 (Table 4). However, the ocular pain, social, and expectations subscales did not demonstrate a linear trend with the combined visual acuity variable. For the combined visual acuity variable, there was no distinct pattern of the associations being driven by the highest category of visual dysfunction.

Association of Clinical Visual Function Measures with the NEI–VFQ Subscales

Rank correlations between the NEI–VFQ subscales and the clinical vision tests ranged from small to modest (Table 5). A moderate correlation ($r = -0.30$) was evident between visual acuity and the general vision NEI–VFQ subscale. Also, a moderate correlation ($r = -0.31$) was evident between color vision and both the role difficulties and peripheral vision NEI–VFQ subscales. There were several correlations for which one would expect to see at least a moderate association, such as visual field and the peripheral vision NEI–VFQ subscale (r = 0.20), color vision and the color vision NEI–VFQ subscale ($r = -0.23$), and visual acuity and near ($r = -0.24$) and distant ($r = -0.21$) activities. Although no strong associations were observed, all these correlations were in the expected direction. The NEI–VFQ expectations and ocular pain subscales were both poorly associated with the visual function tests.

Internal Consistency Reliability

With the exception of the vision-specific expectation subscale ($\alpha = 0.46$), all multi-item subscales demonstrated a moderately strong internal consistency reliability (general health, $\alpha = 0.87$; general vision, $\alpha = 0.74$; ocular pain, $\alpha = 0.72$; near activities $\alpha = 0.89$; distance activities, $\alpha = 0.89$; social functioning, $\alpha = 0.91$; mental health, $\alpha = 0.90$; role difficulties, $\alpha = 0.90$; dependency, $\alpha = 0.92$; driving, $\alpha = 0.86$). The average reliability over the 10 multi-item subscales (omitting the visual expectation subscale) was 0.86.

Abbreviated 25-Item NEI–VFQ

The 25-item abbreviated version of the NEI–VFQ correlated well with the full 51-item field test version. Spearman rank correlations between the two versions were as follows: general health = 0.94; general vision = 0.84; near activities = 0.96; distance activities = 0.95; social functioning = 0.96; mental health = 0.92; role difficulties = 0.96; dependency = 0.88; driving = 0.90. The ocular pain, color, and peripheral vision subscales are equivalent on the two versions. The internal consistency reliability attenuated slightly, with an average coefficient alpha of 0.78 for the eight computable subscales. The coefficient alphas for the 25-item version were as follows: ocular pain = 0.72; near activities = 0.85; distance activities =

Table 3. NEI–VFQ Subscale Scores Compared with an Independent Reference Group

NEI–VFQ Subscale	ONTT Patients* (N = 244)	Reference Group† (N = 122)	P
General health	72 (18)	75 (17)	0.13
General vision	79 (14)	81 (13)	0.19
Ocular pain	87 (16)	90 (15)	0.09
Near activities	90 (13)	93 (10)	0.03
Distance activities	89 (14)	95 (8)	<0.01
Social functioning	97 (10)	99 (3)	0.03
Mental health	85 (16)	91 (11)	<0.01
Expectations	47 (16)	43 (26)	0.07
Role difficulties	89 (17)	96 (9)	<0.01
Dependency	97 (12)	99 (5)	0.08
Driving	84 (16)	89 (14)	<0.01
Color vision	95 (14)	98 (8)	0.03
Peripheral vision	89 (19)	97 (10)	<0.01

Values are mean ± SD.

* Missing data: general health = 1; general vision = 7; ocular pain = 2; near activities = 25; distance activities = 19; social functioning = 9; mental health = 14; expectations = 2; role difficulties = 4; dependency = 8; driving = 11; color vision = 4; and peripheral vision = 7.

† Reference group from Mangione et al.[7]

Table 4. NEI–VFQ Subscales According to Neurologic and Visual Status ($N = 244$)

NEI–VFQ Subscales	CDMS				Visual Acuity			
	No $n = 134$	Yes EDSS <3 $n = 94$	Yes EDSS ≥3 $n = 16$	P for Linear Trend	>20/20 in Both Eyes $n = 150$	>20/20 in One Eye and ≤20/20 in Other Eye $n = 56$	≤20/20 in Both Eyes $n = 38$	P for Linear Trend
Health	76 (15)*	69 (18)†	48 (23)†	<0.01	74 (17)	69 (19)	65 (18)†	<0.01
Vision	79 (12)	79 (15)	69 (21)†	0.08	82 (14)	73 (12)†	74 (15)†	<0.01
Pain	89 (12)	86 (20)	78 (23)†	0.02	88 (15)	83 (20)	89 (14)	0.74
Near vision	93 (10)	89 (14)†	78 (25)†	<0.01	93 (11)	84 (17)†	89 (11)	<0.01
Distant vision	90 (12)	88 (14)	71 (25)†	<0.01	91 (13)	83 (15)†	85 (14)†	<0.01
Social	98 (7)	96 (10)	86 (24)†	<0.01	97 (10)	95 (12)	96 (7)	0.27
Mental health	87 (13)	85 (16)	70 (30)†	<0.01	88 (14)	80 (18)†	81 (18)	<0.01
Expectation	45 (16)	48 (14)	50 (19)	0.08	46 (15)	49 (18)	45 (13)	0.91
Role	93 (12)	87 (19)†	71 (28)†	<0.01	91 (16)	86 (20)	85 (18)	0.02
Dependency	98 (12)	96 (11)	90 (21)	0.07	98 (10)	95 (13)	94 (18)	0.04
Driving	85 (15)	85 (15)	70 (28)†	0.05	87 (14)	76 (19)†	82 (15)	<0.01
Color vision	97 (11)	94 (14)	80 (29)†	<0.01	97 (10)	92 (19)†	90 (19)†	<0.01
Peripheral vision	91 (17)	89 (19)	70 (26)†	<0.01	92 (16)	82 (21)†	88 (22)	0.03

20/20 refers to a logMar value of 0.0.

* Each cell provides the mean (SD) for the subscale. Missing data: see footnote to Table 3.

† Mean difference from "No" or ">20/20 in Both Eyes" group significant at $P < .05$ using Dunnett's multiple comparison test.

0.73; social functioning = 0.78; mental health = 0.82; role difficulties = 0.75; dependency = 0.92; driving = 0.65. Coefficient alphas are not available for the single-item subscales (general health, general vision, color, and peripheral vision). We assessed the usefulness of the abbreviated NEI–VFQ by comparing the rank correlations between this abbreviated version and the clinical visual function measures to those found with the 51-item NEI–VFQ field test version. In short, the abbreviated version provided remarkably similar rank correlations (data not shown), only distinguishable by very slight attenuation on some subscales for some of the clinical measures.

Table 5. Spearman Rank Correlations between Clinical Visual Functions in the Better Eye and NEI–VFQ Subscales ($N = 244$)

NEI–VFQ Subscale	Visual Acuity	Visual Field	Color Vision	Contrast Sensitivity
General health	−0.11	0.19	−0.22	0.20
General vision	−0.30	0.23	−0.19	0.17
Ocular pain	0.04	0.08	−0.14	−0.01
Near activities	−0.24	0.12	−0.26	0.21
Distance activities	−0.21	0.20	−0.21	0.22
Social functioning	−0.08	0.15	−0.22	0.16
Mental health	−0.16	0.14	−0.14	0.21
Expectations	−0.08	−0.07	0.12	−0.10
Role difficulties	−0.11	0.21	−0.31	0.20
Dependency	−0.15	0.19	−0.25	0.17
Driving	−0.19	0.16	−0.05	0.14
Color vision	−0.15	0.21	−0.23	0.20
Peripheral vision	−0.05	0.20	−0.31	0.10

Visual acuity: ETDRS logMar score (lower score = better visual function).

Visual field: Humphrey Field Analyzer mean deviation (higher score = better visual function).

Color vision: Farnsworth–Munsell 100-hue test error score (lower score = better visual function).

Contrast sensitivity: Pelli–Robson chart line number (higher score = better visual function).

Missing data for NEI–VFQ subscales: see Table 3. Missing data for vision tests: visual acuity = 0, visual field = 19; color vision = 10; and contrast sensitivity = 1.

Discussion

In this cohort of 244 patients who participated in the ONTT, NEI–VFQ scores obtained 5 to 8 years after study entry, at a time when maximum recovery had occurred, were generally lower than those reported for a disease-free group,[7] this despite the fact that the disease-free group was older than the ONTT cohort (mean 59 versus 40 years in the present study)[7] and therefore might be expected to report more visual dysfunction than a disease-free group age-matched to the ONTT cohort. Although comparisons of our cohort with this reference group are not ideal, we are not aware of available data for a disease-free population in the same age range as our optic neuritis cohort.

Self-reported dysfunction was greater when MS was present and when visual acuity was abnormal, supporting the construct validity of the NEI–VFQ. Internal consistency reliability was high for most of the subscales. However, correlations between the NEI–VFQ subscales and clinical measures of visual function were moderate at best.

The ability of the NEI–VFQ to distinguish among the subgroups based on visual acuity in both eyes was impressive, considering that even when visual acuity was reduced in both eyes it was generally only a mild decrease (30 of the 38 with visual acuity worse than 20/20 in both eyes had acuity ≥ 20/40 in each eye and only 3 had acuity worse than 20/40 in each eye). The fact that most of the patients had normal or only mildly abnormal measured visual function may have attenuated the correlations between the NEI–VFQ subscales and the clinical measures of visual function. The only two subscales that appeared to be uninformative with respect to the clinical measures of visual function were the ocular pain and the vision expectations subscales. Because optic neuritis was not active at the time of completion of the NEI–VFQ, the ocular pain subscale would not be expected to be meaningfully associated with severity of disease. Furthermore, that these subscales are unrelated to visual function does not imply that the subscales do not capture important independent information that may be predictive of future disease. The vision expectations subscale also performed poorly in another recent test of the psychometric properties of the NEI–VFQ.[7]

The results must be considered in the context of the characteristics of the patients who were included in the study. The subset of included patients appears to be representative of the full ONTT cohort. Although statistically those included were slightly older and more often white than those excluded, the magnitude of the differences was small and not consequential. Patients entered into the ONTT were experiencing their first episode of optic neuritis in the study eye (although the fellow eye could have had prior optic neuritis) and either did not have MS or if it was diagnosed it had not been treated (which in effect excluded patients who had more than minimal MS at the time of entry). Visual recovery from optic neuritis occurs fairly rapidly, with almost all recoverable vision achieved in the first few months after the episode of optic neuritis. Thus, when the NEI–VFQ was administered, 5 to 8 years after study entry, the episode of optic neuritis at enrollment was long resolved. During this period, a substantial proportion of the patients had developed MS (45%) and many (27%) had experienced at least one recurrence of optic neuritis. Even when either of these had occurred, there was generally no or only mild neurologic disability at the time of NEI–VFQ completion, and, as indicated above, visual function in both eyes was usually determined to be normal or near normal.

Gutierrez et al.[8] reported on the influence of glaucomatous visual field loss on HRQL among 147 glaucoma patients and 44 normal-vision reference subjects and found that greater visual field defect (as measured by the Advanced Glaucoma Interventional Study score) in the better eye was significantly associated with lower NEI–VFQ subscale scores, with correlations in the −0.2 to −0.35 range. As can be expected, our estimates among recovered optic neuritis patients were weaker, ranging from 0.12 for rank correlation between visual field and the NEI–VFQ near activities subscale to 0.23 for the rank correlation with the general vision subscale. Gutierrez et al. also reported internal consistency reliabilities ranging from 0.67 (expectations subscale) to 0.93 (distance vision subscale), with 9 of the subscales greater than 0.78, similar to our findings. Parrish et al.[9] also reported on the HRQL among these same 147 glaucoma patients, finding Pearson correlations as large as −0.60 between the NEI–VFQ subscales and Humphrey visual field, and as large as −0.61 between the NEI–VFQ subscales and the AMA visual acuity impairment score. Our largest rank correlation was between visual acuity and the NEI–VFQ general vision subscale (−0.30).

Mangione et al.[7] reported on the psychometric properties (reliability and validity) of the NEI–VFQ among 598 patients with 1 of 5 chronic eye diseases (age-related cataracts, age-related macular degeneration, diabetic retinopathy, primary open-angle glaucoma, and cytomegalovirus retinitis) or low vision from any cause. Internal consistency reliability estimates range from 0.66 (expectations) to 0.94 (near vision), with the majority greater than 0.70, again similar to our results among recovered optic neuritis patients. There was a trend toward lower mean NEI–VFQ subscale scores among cataract and low vision patients compared with the normal-vision reference group, similar to our finding of lower mean NEI–VFQ subscale scores among those with greater MS disability or combined visual acuity.

Although we used the 51-item field-test version of the NEI–VFQ, similar results were observed when we computed scores for the 25-item abbreviated version of the NEI–VFQ. Our findings add support for the use of the NEI–VFQ as a valuable measure of self-reported visual impairment. Although it is unlikely that the NEI–VFQ will have use for diagnosing optic neuritis or determining how it should be treated, it nevertheless has value for patient management by providing the clinician with a comprehensive overview of a patient's functioning in everyday life.

Acknowledgment

For a complete listing of the Optic Neuritis Study Group, see *Archives of Opthalmology* 1997;115:1547.

References

1. Ebers GC. Optic neuritis and multiple sclerosis. *Arch Neurol.* 1985;42:702–704.
2. Fleishman JA, Beck RW, Linares OA, Klein JW. Deficits in visual function after resolution of optic neuritis. *Ophthalmology.* 1987; 94:1029–1035.
3. Beck RW, Cleary PA, Anderson MM, et al. A randomized, controlled trial of corticosteroids in the treatment of acute optic neuritis. *N Engl J Med.* 1992;326:581–588.
4. Beck RW, Cleary PA, Backlund JC, and the Optic Neuritis Study Group. The course of visual recovery after optic neuritis: experience of the Optic Neuritis Treatment Trial. *Ophthalmology.* 1994; 101:1771–1778.
5. Optic Neuritis Study Group. Visual function 5 years after optic neuritis. *Arch Ophthalmol.* 1997;115:1545–1552.
6. Beck RW, Cleary PA, and the Optic Neuritis Study Group. Optic Neuritis Treatment Trial: one-year follow-up results. *Arch Ophthalmol.* 1993;111:773–775.
7. Mangione CM, Lee PP, Pitts J, et al. Psychometric properties of the National Eye Institute Visual Function Questionnaire (NEI-VFQ). *Arch Ophthalmol.* 1998;116:1496–1504.
8. Gutierrez P, Wilson MR, Johnson C, et al. Influence of glaucomatous visual field loss on health-related quality of life. *Arch Ophthalmol.* 1997;115:777–784.
9. Parrish RK, Gedde SJ, Ingrid US, et al. Visual function and quality of life among patients with glaucoma. *Arch Ophthalmol.* 1997; 115:1447–1455.
10. Beck RW, Cleary PA, Trobe JD, et al. The effect of corticosteroids for acute optic neuritis on the subsequent development of multiple sclerosis. *N Engl J Med.* 1993;329:1764–1769.
11. Optic Neuritis Study Group. The five year risk of multiple sclerosis after acute optic neuritis: experience of the Optic Neuritis Treatment Trial. *Neurology.* 1997;49:1404–1413.
12. Cleary PA, Beck RW, Anderson MM, et al. Design, methods, and conduct of the Optic Neuritis Treatment Trial. *Control Clin Trials.* 1993;14:368–372.
13. Optic Neuritis Study Group. The clinical profile of acute optic neuritis: experience of the Optic Neuritis Treatment Trial. *Arch Ophthalmol.* 1991;109:1673–1678.
14. Beck RW, Diehl L, Cleary PA, and the Optic Neuritis Study Group. The Pelli-Robson Letter Chart: normative data for young adults. *Clin Vis Sci.* 1993;8:207–210.
15. Verriest G, Van Laethen J, Uvihls A. A new assessment of the normal ranges of the Farnsworth-Munsell 100-hue test scores. *Am J Ophthalmol.* 1982;93:635–642.
16. Poser CM, Paty DW, Scheinberg L, et al. New diagnostic criteria for multiple sclerosis: guidelines for research protocols. *Ann Neurol.* 1983;13:227–231.
17. Kurtzke JF. Rating neurologic impairment in multiple sclerosis: an expanded disability status scale (EDSS). *Neurology.* 1983;33: 1444–1452.
18. Glass GV, Hopkins KD. *Statistical Methods in Education and Psychology.* Englewood Cliffs: Prentice–Hall; 1984.
19. Snedecor GW, Cochran WC. *Statistical Methods.* Ames, Iowa: Iowa State University Press; 1967.
20. Cronbach LJ. Coefficient alpha and the internal structure of tests. *Psychometrika.* 1951;16:297–334.
21. SAS. *SAS/STAT User's Guide.* Cary, NC: SAS Institute; 1992.