
Self-assessment of the quality of vision: association of questionnaire score with objective clinical tests

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Abstract

Purpose. To investigate the association of a quality of life-visual function questionnaire with an objective clinical test of visual function.

Methods. We have developed a questionnaire to assess self-reported visual satisfaction in ophthalmic patients suffering from chronic eye conditions causing visual impairment. The questionnaire was administered to 120 patients suffering from age-related cataract, chronic open angle glaucoma, age-related macular degeneration, branch retinal vein occlusion, and presbyopia or minor refractive defects. All the participants also underwent determination of visual acuity, contrast sensitivity, glare, and visual field.

Results. The questionnaire has a good reproducibility, a high internal consistency, and is able to discriminate between the different groups of patients. The total questionnaire score is significantly associated with the results of all visual function tests with the exception of glare. When entered into a multiple linear regression model, near visual acuity and contrast sensitivity are still considerably associated with the total questionnaire score. The psychological attitude of the patient towards his/her health problem is also associated with the total average score.

Conclusions. Overall, the model explains 49% of the variance in the average questionnaire score. *Curr. Eye Res.* 17: 506–512, 1998.

Key words: quality of vision questionnaires; self assessment; objective clinical tests; visual impairment

Introduction

In these last years, a number of questionnaires have been developed and tested to explore the impact of ocular diseases on quality of life (1–6). The implicit assumption for the use of

these questionnaires is that traditional clinical measures may not capture the full extent of disability suffered by the patient in every-day life. In other areas, several studies have convincingly demonstrated that these questionnaires can be as sensitive, or even more so, to clinical changes as are traditional variables (7). If clinical variables do not fully explain self-reported variations in function, the possible significance of self-assessed quality of life in evaluating patients management becomes obvious.

To our knowledge, self-reported visual function and quality of life assessment has been demonstrated to be significantly associated with visual acuity, but possible association with other commonly used tests of visual function has only been presented as a report of the Salisbury Eye Examination project (8). The additional information, if any, conveyed by such questionnaires over those obtained with the usual clinical tests, has not therefore been fully ascertained.

We have developed a questionnaire to assess self-reported visual satisfaction by ophthalmic patients suffering from chronic eye diseases that cause visual impairment. We have then studied the association between the questionnaire score and a number of psychophysical tests commonly utilized in clinical activity to assess visual function.

Patients and methods

Study population

One hundred and twenty persons attending the Institute of Ophthalmology of the University of Parma were enrolled in the study. Eligibility criteria required ages 40 to 80 years, sufficient cooperation, no general mobility limitations, and one of the following ocular diagnoses in one or both eyes existing for at least six months: age-related cataract, primary open-angle glaucoma (POAG), age-related macular degeneration (AMD), branch retinal vein occlusion (BRVO), or minor refractive errors (<5 diopters) or presbyopia, and having no other ocular pathology. The patients with age-related cataract had no other

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ocular pathology, and had been admitted to the Institute for cataract surgery in the first ($n = 22$; 65%) or second eye ($n = 12$; 35%). The diagnosis of POAG was based on (i) high IOP (>21 mm Hg) at repeated measurements, (ii) visual field defect consistent with a glaucoma in at least one eye, and (iii) evidence of optic nerve head cupping. All patients with POAG showed an IOP ≤ 18 mm Hg, with or without proper medical therapy. Four of them (12%) received a previous filtering procedure in one eye not earlier than 1–2 years from enrollment. AMD included both atrophic and exudative/neovascular forms in at least one eye, with no previous laser treatment. The BRVO group included subjects with a normal fellow-eye and who received no laser treatment in the affected eye. The levels of visual function impairment for each group are detailed in Table 1. No refusals to participate were obtained. All patients gave written informed consent and the tenets of the declaration of Helsinki were followed throughout the study, which was approved by the University of Parma Ethics Committee. Most of the participants underwent all clinical tests and questionnaire administration in the same day if possible, a minority within a maximum of four consecutive days. If a patient was admitted for surgery, all data were collected prior to surgery. Two ophthalmologists (A. C. and L. B.) administered the questionnaires and performed all clinical tests on all participants.

Psychophysical tests

The following clinical tests were performed on each participant.

Distance visual acuity was assessed separately in both eyes, with the distance optical correction in use (if any), utilizing the ETDRS chart (9) and the procedure of the Age-Related Eye Disease Study, by counting the number of letters correctly

identified. Weighed distance visual acuity (WDVA) was calculated as 75% of acuity in the better and 25% in the worse eye (10). Score range was 0–85 for each eye. Ten eyes (3 patients with AMD, 5 with POAG and 2 with cataract) had a monocular score of zero (less than one letter at 1 m distance).

Near visual acuity was assessed separately in both eyes with the near optical correction in use (if any), utilizing a chart containing the same letter sequence of the ETDRS chart with a 52% increase of MAR between each line. The chart had 5 lines of 5 letters each. Log MAR range was 0.2 to 1.0, the interval between subsequent lines being 0.2 LogMAR. Score range was 0–25 for each eye. Weighed binocular acuity for near (WNVA) was again calculated as detailed above.

Contrast sensitivity was assessed separately in both eyes with the Pelli-Robson chart (11) and was expressed as the log contrast sensitivity corresponding to the last group of three letters read with less than one error. The score was calculated as binocular contrast sensitivity (BCS), as detailed for visual acuity.

Glare was expressed as the difference between basal contrast sensitivity and contrast sensitivity during glare produced by a torch (4,000 candles/m²) held at a distance of 30 cm and with an angle of 20° in front of the eye. Binocular glare (BG) was detailed as described above.

Visual field was assessed with two-level screening Octopus 07-2LT program (12). The program tests, with a two-level strategy, 48 points with 6° resolution in the 30° area, and 82 points with 15° resolution in the 30–70° area. Monocular score was calculated by assigning 1 to each point with normal sensitivity, 0.5 to each point with a relative defect, and 0 to each point showing an absolute defect. The sum of the two monocular scores was utilized for the analysis to indicate binocular visual field (BVF). Score range was 0–260.

Table 1. Characteristics of study population

	Presbyopia or minor refractive problems	POAG	Cataract	Retina	Total
Number	20	33	34	33	120
Age	56.3 (9.5)	65.4 (11.3)	69.3 (6.6)	68.4 (8.7)	65.8 (10.1)
Male, %	35	48	32	51	42
Female, %	65	52	68	49	58
VA impairment*, %					
Mild	100	67	44	70	67
Moderate	0	30	47	24	28
Severe	0	3	9	6	5
VF impairment†, %					
Mild	85	27	50	58	52
Moderate	15	49	44	39	39
Severe	0	24	6	3	9

*Mild = WMAR ≤ 0.5 ; moderate = WMAR $> 0.5, \leq 1$; severe = WMAR > 1 . WMAR is the weighed average logMAR, with the better eye, given a weight of 0.75 and the worse eye, given a weight of 0.25. †Mild = score 174–260; moderate = score 87–173; severe = score 0–86. Score is the sum of the two monocular field scores (130 tested points in each field).

Table 2. Quality of Life and Vision Function Questionnaire: Interobserver Agreement (N = 20)

	Unweighted kappa
Preliminary questions (do not contribute to questionnaire's score)	
A. In general would you say your health is	0.48
B. Do you think you get sick more frequently than other persons?	0.72
C. Are you pessimistic regarding your health?	0.58
Overall self-assessment of visual satisfaction	
1. Does the quality of your vision prevent you from performing your ordinary daily activities normally?	0.53
2. Are you unhappy about your visual condition?	0.85
3. How much are you concerned with a possible worsening of your visual condition?	0.22
4. Because of your visual problems do you feel less inclined to meet people, friends/relatives?	0.56
5. Because of your visual problems do you feel useless or a burden to others?	0.21
Self-assessment of visual field	
6. Because of your vision do you have problems crossing a street?	0.44
7. Because of your vision do you bump against other people when in crowded areas?	0.66
8. Because of your vision do you have problems in perceiving a dip on the ground or a step?	0.79
Self-assessment of distance visual acuity	
9. Because of your vision do you have problems in reading prices in a shop window?	0.44
10. Because of your vision do you have problems in recognizing people across the street?	0.40
11. Because of your vision do you have problems in recognizing a person in a crowded room?	0.43
Self-assessment of near visual acuity	
12. Because of your vision do you have problems in reading an article in a news-paper or names/numbers in the telephone directory?	0.45
13. Because of your vision do you have problems in doing a manual activity such as cooking, sewing, cutting your nails?	0.50
Self-assessment of sensory adaptation (light-dark adaptation, glare)	
14. Does your vision deteriorate in bright light (for instance on a sunny day)?	0.43
15. Does your vision deteriorate in dim light (for instance at dusk)?	0.31
16. Do you have a driving licence?	
If "YES": how much is your driving disturbed by the lights of oncoming cars?	
If "NO": how much is your vision disturbed by the lights of oncoming cars?	0.60
Self-assessment of color vision	
17. How much problem do you have in recognizing colors?	0.54

Functional status and quality of life assessment

The interviewer-administered questionnaire consists of 17 questions detailed in Table 2. Selection of appropriate items for inclusion in the questionnaire was determined by a consensus discussion among the authors. Some of the questions were derived from the questionnaire developed by Fletcher *et al.* (5) and adapted to the Italian population.

The questionnaire can be completed in less than 10 min, and is divided into six subgroups exploring the following aspects of visual function:

- group 1 (questions 01–05)—dealing with an overall self-assessment of visual satisfaction
- group 2 (questions 06–08)—self-assessment of visual field
- group 3 (questions 09–11)—self-assessment of distance visual acuity
- group 4 (questions 12–13)—self-assessment of near visual acuity

- group 5 (questions 14–16)—self-assessment of sensory adaptation (light/dark adaptation, glare)
- group 6 (question 17)—self-assessment of color vision.

The questions listed in Table 2 are the "best translation" of the questions from Italian to English. For each question, a three point scale was used: "not at all" = 1, "quite a lot" = 2, and "very much" = 3. A higher score corresponded to a better quality of vision. The score of each subgroup of questions was the mean of the scores of each single question. The total questionnaire score was obtained as the mean of the six subgroup scores.

Three additional questions (A, B, and C), which did not contribute to the questionnaire score, were presented to the patients at the beginning of the interview, with the intent to explore their personal attitude with regard to their health condition. Each patient was asked for a 1 to 4-scale answer, the higher scores indicating more optimistic views.

Table 3. Non-parametric analysis of variance (Kruskal-Wallis; two-tailed p) of subgroup* and total average scores by type of disease

	1	2	3	4	5	6	Total
CAT vs POAG	.14	.06	.003	.002	.003	.19	<.001
CAT vs NORM	<.001	<.001	<.001	<.001	<.001	.31	<.001
CAT vs RETINA	.68	<.001	.03	.03	<.001	.02	<.001
POAG vs NORM	<.001	<.001	.01	.23	.11	.91	.001
POAG vs RETINA	.19	.06	.46	.12	.05	.30	.30
RETINA vs NORM	<.001	.01	.003	.02	.96	.29	.005

*1 = Overall self-assessment of visual satisfaction, 2 = Self-assessment of visual field, 3 = Self-assessment of distance visual acuity, 4 = Self-assessment of near visual acuity, 5 = Self-assessment of sensory adaptation, 6 = Self-assessment of color vision. NORM = Presbyopia and minor refractive problems; CAT = cataract; RETINA = AMD and BRVO.

Inter-observer reproducibility

Inter-observer reproducibility for the interview was measured, before the start of the study, on 20 additional subjects with the same characteristics of study participants. The order of the interviewers was randomly assigned. The repeat interview was administered within eight h of the first interview. The subjects selected for evaluation of reproducibility were mostly (13/20) cataract patients admitted to the Institute of Ophthalmology for surgery.

Statistical analysis

Nonparametric analysis of variance (Kruskal-Wallis) was used to test for differences in the questionnaire score by type of pathology. Spearman rank correlation coefficients were calculated to test the association of the results of the psychophysical tests and of the additional questions A, B, and C, with the questionnaire score. After standardization of the data, multiple regression analysis was used to examine the independent associations of WDVA, WNVA, BCS, BG, BVF, age, sex, ocular pathology, and questions A, B, and C with the questionnaire score.

The Cronbach alpha was used to assess the internal consistency of the questionnaire. Interobserver agreement was evaluated by the unweighted kappa statistics. The data were double-entered and analyzed by use of commercially available software (SAS System).

Results

Characteristics of the study population are reported in Table 1

Reproducibility

Repeatability studies measured in a separate patient population and assessed by kappa statistics indicate a good reproducibility (Table 2). Kappa scores for individual questions ranged from 0.22 to 0.85, with 13 questions over 17 (76%) showing an unweighted kappa ≥ 0.4 , and four questions (23%) with an unweighted kappa ≥ 0.6 . Preliminary questions not contributing to the questionnaire score but rather intended to explore the

patient's psychological reaction to the disease were also highly reproducible.

Reliability

The questionnaire's total score showed high internal consistency. For the total score, the Cronbach α was 0.89, with an average corrected item-total correlation of 0.54 (SD = 0.17).

Validity

To test between groups' validity, we compared the subgroup scores and the mean average questionnaire score among the four groups of patients by means of non parametric analysis of variance (Kruskal-Wallis) (Table 3). The questionnaire was able to significantly discriminate ($p < 0.001$) between the patients with presbyopia and minor refractive problems and those with ocular pathology, and also among the three main pathology groups (cataract, PAOG, and AMD or BRVO).

Associations between questionnaire score and psychophysical variables

The results of univariate analysis are reported in Table 4. With the exception of age, sex (data not shown), and glare, all other variables tested were significantly associated with the average questionnaire score. Out of the three preliminary questions exploring the patients' psychological attitudes towards their disease, questions A and B were significantly related to the total average score (Table 4).

When WDVA, WNVA, BCS, BG, and BVF were entered into a linear multiple regression model against the average questionnaire score as the dependent variable, near visual acuity and contrast sensitivity were still significantly associated with the average score. WDVA does not contribute significantly to the model, due to the high degree of colinearity with WNVA. Forty-two percent of the variance in the total score was explained by the model, with visual acuity and contrast sensitivity being the main explanatory variables. If questions A, B, and C were entered into the model, question B was also significantly associated with the total score, together with WNVA and BCS, and the final model explained forty-nine per-

Table 4. Spearman's correlation coefficients of average questionnaire score and psychophysical variables: univariate analysis

Variable	Spearman's r	p
Weighed distance VA	0.489	<.001
Weighed near visual acuity	0.551	<.001
Contrast sensitivity	0.550	<.001
Glare	-0.068	0.4
Visual field	0.384	<.001
Question A	0.226	0.01
Question B	0.225	0.01
Question C	0.076	0.4

cent of the variance (Table 5). Residuals were normally distributed and there were no outliers which could influence the results. If this final model was run after stratifying by ocular pathology, the percent of the score variance explained was 56% for age-related cataract, 44% for POAG, 53% for retinal diseases (AMD and BRVO), while, for minor refractive errors and presbyopia, no significant association was detected.

Discussion

A questionnaire to collect information on self-reported visual satisfaction in ophthalmic patients suffering from chronic eye diseases causing different levels of visual impairment was developed. The questionnaire was administered to 100 patients with cataract, POAG, AMD or BRVO, and to 20 patients with presbyopia or minor refractive disorders but no ocular disease. As a first step, we demonstrated the validity and internal consistency of the questionnaire. The questions listed in Table 2 are actually an English translation of the items used in the Italian population under study. Therefore the validity and internal consistency of the questionnaire might not be applied to the English version. Besides, due to the limited number of patients with very severe visual impairment (see Table 1), we cannot assess the actual amount of information conveyed by this instrument if used with a more significantly impaired population.

We then employed regression analysis to study whether the questionnaire score was associated with the results of a number of psychophysical tests commonly used in clinical practice to assess visual function. Our objective was to explore the amount of additional information, if any, which this type of instrument, easy to understand and administer, might provide as a supplement to traditional physiological measures of visual function. A correlation between visual acuity and the score of different types of quality of life and visual function questions was demonstrated by several independent studies (4, 5, 6, 13, 14), but reports on the association with other types of psychophysical variables are very few. A linear relationship between visual field loss in the better eye in patients with glaucoma and greater disability on the NEI-VFQ has recently been reported (14). With the exception of glare, our questionnaire score was significantly correlated with the results of all the psychophysi-

Table 5. Association between average questionnaire score and visual function and psychological variables: multiple regression analysis

Independent variable	Regression coefficient	T	p
Weighed distance VA	-0.0209	-0.157	0.87
Weighed near VA	0.3254	2.619	0.01
Contrast sensitivity	0.3462	2.753	0.007
Glare	-0.0051	-0.071	0.94
Visual field	0.1053	1.234	0.22
Question A	0.0840	1.072	0.28
Question B	0.2526	3.307	0.001
Question C	-0.0673	-0.866	0.39

F = 13.596; p = 0.0001; R² = 0.49.

cal tests. This indicates that perceived difficulties in everyday activities are related not only to visual acuity but also to different objective measures of visual function. When data were entered into a multiple linear regression model, together with the three general questions aimed to assess the patient's psychological reaction to the disease, BCS and WNVA were still significantly associated with the total questionnaire score. Moreover, not unexpectedly, the questionnaire score may be influenced by the psychological attitude of the patient towards his/her health problem.

When applied to the whole population of our patients, the model explains 49% of the variance in the total score. This might support the possibility that the questionnaire conveys additional information on the patient's visual satisfaction over those provided by the most commonly used clinical tests. It is difficult to rule out the importance of random variability in the unexplained portion of the score, and it is possible that other variables such as socioeconomic status, living situations, medication use, etc. may play a role.

As this study is cross-sectional, the possible capability of this questionnaire to adequately monitor changes of patient visual satisfaction over time would require assessment in a longitudinal study.

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