

The impact of phacoemulsification surgery on vision-related quality of life in senile cataract patients

Cetin Akpolat^{ID}, Mehmet Demir, Seval Cevher, Sibel Zorlu Ozturk and Sumeyra Yesiltas

Abstract

Background: Phacoemulsification surgery may have beneficial effects on the quality of life of patients with senile cataract. These effects can be evaluated with the help of questionnaires and tests.

Purpose: To evaluate the effect of the phacoemulsification surgery on the vision-related quality of life (VR-QOL) in patients with senile cataract using the 25-item National Eye Institute Visual Functioning Questionnaire (NEI-VFQ-25) and functional independence measure (FIM) tests.

Methods: The data collection was prospective. NEI-VFQ-25 and FIM tests were measured by a masked ergo-therapist. The patients who underwent phacoemulsification surgery were included in this study. Mean best-corrected visual acuity (BCVA), NEI-VFQ-25 and FIM scores were compared in the preoperative period and at least 3 months after the surgery according to demographic properties including gender, age, education status, as well as the BCVA level and laterality.

Results: Preoperative mean BCVA and NEI-VFQ-25 composite scores improved significantly ($p < 0.001$ and $p = 0.001$, respectively). All NEI-VFQ-25 subscale scores except the general health ($p = 0.235$) and driving ($p = 0.226$) showed a significant postoperative increase. The postoperative NEI-VFQ-25 composite scores showed a significant increase in all subgroup analyses ($p < 0.05$ for all). Patients with poorer BCVA, bilateral surgery, and low education status had lower preoperative NEI-VFQ-25 composite scores than the patients with better BCVA, unilateral surgery, and high education status ($p = 0.026$, $p = 0.016$, and $p = 0.032$, respectively). All FIM scores were similar in the preoperative and postoperative periods regardless of subgroup analyses ($p > 0.05$ for all).

Conclusion: Phacoemulsification surgery can provide a satisfying improvement in VR-QOL in patients with cataracts. As a valid and reliable test, the NEI-VFQ-25 scale can be used to measure the visual function after the ocular surgeries.

Keywords: phacoemulsification surgery, vision-related quality of life, visual function, Visual Functioning Questionnaire

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Introduction

Cataract is the leading cause of treatable visual loss worldwide. It is specifically defined as any size of opacification due to congenital, metabolic, traumatic, or senile reasons in one or more layers of the crystalline lens causing light diffraction and visual impairment.^{1,2} The only effective treatment method is the surgical removal of the crystalline lens and implantation of an intraocular lens.

There have been innovations in the field of cataract surgery, from anesthesia to phacoemulsification and intraocular lenses, and cataract surgery has even become an outpatient procedure. Beyond this, the search for a valid method to assess the effectiveness and results of these new treatment methods for improving patients' quality of life (QOL) is also ongoing. Due to its prevalence and considering that the elderly population

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Correspondence to:

Cetin Akpolat
Department of
Ophthalmology, Sisli
Hamidiye Etfal Training
and Research Hospital,
Sisli, Istanbul, 34371,
Turkey.
akpolatcetin@yahoo.com

Mehmet Demir
Sibel Zorlu Ozturk
Sumeyra Yesiltas
Department of
Ophthalmology, Sisli
Hamidiye Etfal Training
and Research Hospital,
Istanbul, Turkey

Seval Cevher
Department of
Ergotherapy, Sisli
Hamidiye Etfal Training
and Research Hospital,
Istanbul, Turkey



is increasing worldwide, cataract is a public health problem not only because it causes visual impairment but also because of the consequences of visual impairment leading to social, economic, and psychological problems.³ Visual loss caused by cataract can impair the patients' QOL, increase their dependency, disable their social condition, and thus may result in early retirement.⁴ Vision recovery treatment using cataract surgery can provide social and economic benefits to the individuals, their families, and the public as a whole.⁵

The QOL is defined as various aspects representing the health status, which means not only the absence of disease but also physical, psychological, mental, and social comfort. The most emphasized measurable objective criterion to detect the success of the treatment in the field of ophthalmology (including cataract surgery) is the improvement of visual acuity (VA). However, VA alone cannot sufficiently reflect the patient's QOL and thus may cause the underestimation of the value of the cataract surgery. VA and vision-related quality of life (VR-QOL) parameters, including functional recovery and alterations in daily activity, should be combined to measure the patient's QOL and satisfaction in the evaluation of cataract surgery. For that purpose, several surveys have been introduced to assess the impact of visual impairment on daily functions and VR-QOL.⁵⁻⁷ The American National Eye Institute Visual Function Questionnaire (NEI-VFQ) developed by Mangione *et al.* is one such survey that has been widely used in several studies to evaluate the effects of the treatment.⁸ Packer *et al.* later described the term visual function as the effect of VA on the QOL or the capacity to realize daily activities directly related to visual usefulness.⁹ Recovery of functional ability in the postoperative period can also be assessed by the functional independence measure (FIM) instrument, which is a valid and reliable tool usually used for patients undergoing rehabilitation.¹⁰

Several studies have been conducted to measure the impact of cataract surgery on visual function related to QOL using various questionnaires, including the NEI-VFQ. This study was conducted to assess VR-QOL in patients diagnosed with senile cataract using the FIM instrument in addition to the 25-item NEI-VFQ (NEI-VFQ-25) before the phacoemulsification surgery and at least 3 months after the surgery.

Methods

Patients

The prospectively designed study was conducted in the Cataract and Refractive Surgery Unit of Sisli Hamidiye Etfal Training and Research Hospital (Istanbul, Turkey), which is a tertiary eye clinic. Patients with visual impairment due to cataract described according to the lens opacities classification system III scoring were eligible for the study.¹¹ Study participants were recruited from the patients who were undergoing phacoemulsification surgery. The NEI-VFQ-25 was applied to these patients before the surgery and at least 3 months after the surgery. All surgeries were performed by the same surgeon. Patients were included in the study according to the following criteria: being at least 50 years old, having the ability to complete the NEI-VFQ-25, having visual impairments only due to existing senile cataracts, lacking previous ocular surgery (including refractive surgery), and lacking ocular comorbidities, including corneal opacities, glaucoma, diabetic retinopathy, maculopathy, and chorioretinopathy, which may lead to visual impairment. The exclusion criteria were as follows: being unable to complete the NEI-VFQ-25 due to dementia or any other communication disabilities, having any complications that may affect visual quality during or after the surgery, being of pediatric age, having traumatic cataract, or having any systemic diseases or comorbidities at a level affecting QOL.

Overall, 124 eyes of 85 patients meeting these criteria were included in this study. All patients had a detailed ophthalmological examination, including best-corrected visual acuity (BCVA, converted to log MAR from the Snellen equivalent), biomicroscopic anterior segment examination, intraocular pressure (IOP, mm Hg) measured with pneumatic tonometry, and fundus examination before and after the phacoemulsification surgery. In addition to the application of the NEI-VFQ-25 to measure the VR-QOL and the FIM; demographic properties, and clinical characteristics of the patients were also reviewed, such as gender, age, education status, existing systemic comorbidity, follow-up time, the laterality of the eye, and the type of cataract. VR-QOL variables included physical domains (near vision and far vision) and the level of independence (daily activities, social activities, physical activities, and capacity to drive an automobile). The main parameters assessed for the statistical analysis of

the VR-QOL were BCVA values, the NEI-VFQ-25 scores, and FIM ratings. The patients were assessed in various groups, including BCVA (in decimal) level, gender, age range, laterality, and education level according to the NEI-VFQ-25 and FIM tests.

The NEI-VFQ-25 and the FIM

The NEI-VFQ-25 includes 25 items measuring the level of difficulty regarding particular visual symptoms and daily activities. Each item is assigned to one of the following 12 subscales: general health, general vision, ocular pain, near activities, distance activities, social functioning, mental health, role difficulties, dependence, driving, color vision, and peripheral vision. The subscale and composite calculations are scored from 0 to 100 points, with higher values representing favorable results regarding the patient's VR-QOL. The NEI-VFQ-25 was administered to the patients who had bilateral phacoemulsification surgery before the procedure on the first eye and at least 3 months after the procedure on the second eye.

We also assessed the FIM instrument, a valid and reliable tool used to monitor the recovery of functional ability by people undergoing rehabilitation.^{12,13} The FIM evaluation comprises 18 activities of self-care, sphincter control, transferring, locomotion, communication, social interaction, and cognition. Each activity on a 7-point ordinal scale (1 = totally unable, 7 = totally independent) gives a total range between 18 (minimum) and 126 (maximum). Both the NEI-VFQ-25 and FIM tests were administered by an experienced and masked ergo-therapist.

Statistics

Statistical analysis of the patient data was performed using SPSS for Windows, version 21.0 (IBM Corp., Armonk, NY, USA). Continuous variables were presented as the mean \pm standard deviation. Preoperative and postoperative changes were analyzed using the Bonferroni correction and paired-samples *t* tests. A *p* value < 0.05 was considered statistically significant within the 95% confidence interval.

Results

The demographic data of the patients are presented in Table 1. The number of male and female patients was similar. The mean age values

of male and female patients were also similar. Nearly half of the patients had bilateral phacoemulsification surgery. Approximately 65% of the patients had a low educational status. The patients were followed for at least 3 months postoperatively, with an insignificantly longer mean time duration for female patients. Nuclear cataracts comprised more than half of the senile cataracts. Pseudo-exfoliation was observed in nine eyes. The patients were followed up with for an average of 10.24 ± 8.48 months. Twelve eyes had dry eye disease and one eye had exotropia. Fifteen patients had only hypertension, 18 patients had only diabetes mellitus, 13 patients had hypertension and diabetes mellitus, and 3 patients had coronary artery disease. No complications were observed in the postoperative period.

The preoperative FIM ratings (121.72 ± 8.16) of all patients at admission did not show significant changes in the postoperative period (123.40 ± 5.54) ($p = 0.62$). The preoperative FIM ratings also did not show any difference in the postoperative period of all subgroups ($p > 0.05$ for all).

The mean NEI-VFQ-25 composite score of all patients showed a statistical increase in the postoperative period compared with the preoperative period. The mean NEI-VFQ-25 subscale scores – except for general health, ocular pain, and driving – increased significantly after the phacoemulsification surgery (Table 2).

The preoperative mean log MAR BCVA values improved from 0.62 ± 0.079 to 0.17 ± 0.66 ($p < 0.001$) in the postoperative period. Similar preoperative ($p = 0.136$) and postoperative ($p = 0.248$) mean log MAR BCVA values were present in female and male patients. This similarity was also observed in the preoperative and postoperative mean log MAR BCVA according to age range ($p = 0.086$ in the preoperative period and $p = 0.174$ in the postoperative period) and education level ($p = 0.072$ in the preoperative period and $p = 0.096$ in the postoperative period). Bilateral cases had poorer preoperative log MAR BCVA than unilateral cases ($p = 0.012$). The preoperative mean IOP (16.28 ± 4.56 mm Hg) of all patients was similar to the postoperative mean IOP (15.44 ± 5.02 mm Hg) ($p = 0.408$).

Multivariate regression analysis results showed a statistically significant relationship between the preoperative NEI-VFQ-25 composite score and the preoperative log MAR BCVA ($p = 0.001$). All

Table 1. Demographic properties, education level, and follow-up duration of the patients.

| Feature | Numbers | <i>p</i> |
|--|-----------------------|----------|
| Gender (<i>n</i> , %) | | 0.386 |
| Male | 41 (48.24%) | |
| Female | 44 (51.76%) | |
| Total | 85 (100%) | |
| Age (years, mean ± SD) (range) | | 0.645 |
| Overall mean | 64.79 ± 10.91 (32–85) | |
| Male mean | 64.22 ± 11.85 (32–85) | |
| Female mean | 65.32 ± 10.06 (38–79) | |
| Cataract type (<i>n</i> , %) | | |
| Nuclear | 65 (52.42%) | |
| Posterior capsular | 21 (16.94%) | |
| Cortical | 9 (7.26%) | |
| Mature | 12 (9.68%) | |
| Mix | 17 (13.70%) | |
| Total | 124 (100%) | |
| Laterality (<i>n</i> , %) | | – |
| Right | 26 (30.59%) | |
| Left | 20 (23.53%) | |
| Bilateral | 39 (45.88%) | |
| Total | 85 (100%) | |
| Education level (<i>n</i> , %) | | – |
| Low | 55 (64.70%) | |
| High | 30 (35.30%) | |
| Total | 85 (100%) | |
| Follow-up duration (month, mean ± SD), (range) | | 0.162 |
| Overall mean | 10.24 ± 8.48 (3–60) | |
| Male mean | 7.73 ± 6.32 (3–48) | |
| Female mean | 12.56 ± 12.55 (3–60) | |
| SD, standard deviation. | | |

preoperative NEI-VFQ-25 subscale scores except general health and driving also showed a statistically significant relationship with preoperative log MAR BCVA ($p < 0.05$ for all). Preoperative dependency ($p = 0.010$) and social functioning ($p = 0.022$) subscale scores showed a significant relationship with age. To predict the improvement in VR-QOL after cataract surgery, a multiple regression analysis was also performed between the postoperative NEI-VFQ-25 scores and preoperative variables. We noted that the postoperative improvement in the NEI-VFQ-25 composite score showed a significant correlation with a low preoperative NEI-VFQ-25 composite score ($p = 0.002$) and a poorer preoperative log MAR BCVA ($p = 0.014$). The postoperative improvement of all NEI-VFQ-25 subscales also showed a significant correlation with a low preoperative subscale score ($p < 0.05$ for all). The postoperative improvement of all NEI-VFQ-25 subscales except general health, ocular pain, and driving showed a significant correlation with a poorer preoperative log MAR BCVA ($p < 0.05$ for all).

The patients' mean NEI-VFQ-25 composite scores were evaluated in five different groups: BCVA (in decimal) level, gender, age range, laterality, and education level. In the intra-subgroup analysis, there was a significant improvement in the preoperative mean NEI-VFQ-25 composite scores of all subgroups of the five groups after the phacoemulsification surgery. Comparing the preoperative inter-subgroup mean NEI-VFQ-25 composite scores showed a significant difference between the subgroups of BCVA level, laterality, and education level, whereas postoperative outcomes were similar in all subgroups (Table 3).

The changes between the preoperative and postoperative NEI-VFQ-25 composite scores of the patients were also compared with evaluate the significance of the difference in the change. It was observed that the changes in three factors (education level, unilaterality or bilaterality, and preoperative BCVA) were significant. Patients with a high education level had a greater change than the patients with a lower education level ($p = 0.024$). Patients who underwent bilateral phacoemulsification showed a greater change than the patients who underwent unilateral phacoemulsification ($p = 0.036$). Patients with poorer preoperative BCVA also had a greater change than the patients with better preoperative BCVA ($p = 0.030$).

Table 2. Preoperative and postoperative mean NEI-VFQ-25 composite and subscale scores of the patients.

| NEI-VFQ-25 subscale | Preop. score | Postop. score | <i>p</i> value |
|----------------------|---------------|---------------|----------------|
| General Health | 54.59 ± 26.69 | 57.04 ± 12.84 | 0.135 |
| General Vision | 44.00 ± 18.46 | 76.47 ± 14.79 | <0.001* |
| Ocular Pain | 56.18 ± 25.24 | 61.34 ± 14.39 | 0.106 |
| Near Activities | 60.99 ± 17.20 | 80.27 ± 13.26 | <0.001* |
| Distance Activities | 61.10 ± 19.64 | 78.41 ± 12.06 | <0.001* |
| Social Functioning | 79.83 ± 14.96 | 94.34 ± 10.56 | 0.001* |
| Mental Health | 74.97 ± 17.52 | 86.29 ± 13.39 | 0.001* |
| Role Difficulties | 79.18 ± 15.92 | 90.82 ± 11.27 | 0.034* |
| Dependency | 82.18 ± 24.25 | 94.16 ± 12.51 | 0.001* |
| Driving ^a | 64.46 ± 24.41 | 69.77 ± 13.70 | 0.066 |
| Color Vision | 85.53 ± 13.93 | 94.06 ± 10.26 | 0.015* |
| Peripheral Vision | 81.88 ± 22.17 | 95.76 ± 12.22 | 0.001* |
| Composite Score | 69.06 ± 14.14 | 85.47 ± 11.05 | 0.001* |

NEI-VFQ, National Eye Institute-Vision Function Questionnaire; postop., postoperative; preop., preoperative.
^aLimited number of patients (*n*) = 37.
*Statistically significant.

The patients' mean NEI-VFQ-25 subscale scores were also evaluated in five different groups in addition to the composite scores. In the intra-subgroup analysis, preoperative mean NEI-VFQ-25 subscale scores – except for general health, ocular pain, and driving – increased significantly in all subgroups of the five groups in the postoperative period ($p < 0.05$ for all). None of the comparisons regarding the preoperative inter-subgroup mean NEI-VFQ-25 subscale scores in the gender and age range subgroups showed a significant difference. All preoperative mean NEI-VFQ-25 subscale scores – except for general health, ocular pain, and driving – in the BCVA-level subgroup were statistically lower in the patients with poorer BCVA than the patients with better BCVA ($p < 0.05$ for all). Similarly, all preoperative mean NEI-VFQ-25 subscale scores – except for general health, ocular pain, and driving – in the education-level subgroup were statistically lower in the patients with high educational status than the patients with low educational status ($p < 0.05$ for all). The patients who had bilateral phacoemulsification surgery presented with lower preoperative mean NEI-VFQ-25 subscale scores – except for

general health, ocular pain, driving, and color vision – than the patients who had unilateral phacoemulsification surgery ($p < 0.05$ for all). However, all mean NEI-VFQ-25 subscale scores were similar in all inter-subgroup analyses in the postoperative period.

Discussion

Questionnaires assessing the impact of any treatment method on patients' QOL life provide more comprehensive information.¹⁴ Concrete data obtained from these questionnaires on how therapeutic interventions affect patients' QOL also provides valuable information to decision-makers about the determination of general health policies. For those purposes, a new concept has been developed as health-related QOL that defines the effects of treatment and disease severity on patients' lives, which has focused on mobility limitation, social and psychological health, cognitive state, or pain. Parallel to this, questionnaires that evaluate patient-based subjective visual functions are also being developed. VA alone cannot provide sufficient information about the impact of cataract

Table 3. Subgroup analysis of preoperative and postoperative NEI-VFQ-25 composite scores of the patients.^a

| Subgroup | Preop. score | Postop. score | p value |
|---|-------------------|-------------------|---------|
| BCVA (in decimal) ≤ 0.2 ($n = 52$) | 64.38 \pm 10.02 | 85.56 \pm 10.56 | <0.001* |
| BCVA (in decimal) 0.3–0.5 ($n = 72$) | 72.84 \pm 11.35 | 85.14 \pm 10.02 | 0.002* |
| p values | 0.026* | 0.526 | |
| Male gender ($n = 41$) | 70.29 \pm 11.56 | 84.09 \pm 12.36 | 0.001* |
| Female gender ($n = 44$) | 67.90 \pm 13.59 | 82.80 \pm 11.72 | 0.001* |
| p values | 0.314 | 0.583 | |
| Age <65 years | 69.29 \pm 13.21 | 85.11 \pm 11.45 | 0.001* |
| Age ≥ 65 years | 68.88 \pm 9.73 | 85.75 \pm 10.18 | 0.001* |
| p values | 0.860 | 0.786 | |
| Unilateral phacoemulsification | 73.42 \pm 16.28 | 86.62 \pm 11.26 | 0.002* |
| Bilateral phacoemulsification | 64.22 \pm 17.02 | 83.47 \pm 10.05 | <0.001* |
| p values | 0.016* | 0.184 | |
| Low education level | 74.33 \pm 10.88 | 85.38 \pm 12.93 | 0.001* |
| High education level | 66.82 \pm 11.66 | 85.84 \pm 11.85 | 0.001* |
| p values | 0.032* | 0.486 | |

BCVA, best-corrected visual acuity; NEI-VFQ, National Eye Institute–Vision Function Questionnaire; postop., postoperative; preop., preoperative.
^aSimilar mean log MAR BCVA values were present between all subgroups divided according to gender, age range, and education level except the BCVA level.
*Statistically significant.

surgery on patients' QOL. Thus, properly tailored questionnaires are required to measure visual functional recovery and how patients' lives are affected after the surgery.

Several questionnaires have been introduced to assess visual function. The NEI-VFQ, which was developed in 1998 by Mangione *et al.*,⁸ is one of the commonly used questionnaires. It was originally prepared as a long version consisting of 51 questions, and later on, the 25-question format was developed to provide easier clinical application.¹⁵ The NEI-VFQ-25 test consists of 25 questions regarding patient complaints and capabilities in the following areas: general health, general vision, eye pain, near vision, distant vision, social interaction related to vision, mental health related to vision, vision-related role difficulties, visual dependence on others, driving, color vision, and peripheral vision. Compared with other visual function scales,

the NEI-VFQ includes some additional information about the patients' VR-QOL, which is associated with the cognitive level and depressive mood especially in elderly patients, as well as how they cope emotionally and psychologically.¹⁶

In our study, we applied the NEI-VFQ-25 test to our patients before and at least 3 months after the phacoemulsification surgery to evaluate the effects of cataract symptoms on daily functions and the psychological status of the patients. We found a statistically significant increase in the postoperative mean NEI-VFQ-25 composite and subscale scores – except for general health, ocular pain, and driving subscales regardless of whether the patient underwent unilateral or bilateral ocular surgery, indicating the successful treatment outcome of the phacoemulsification surgery and subsequent improvement in the patients' VR-QOL. As would be expected, our results showed that VA was

weakly associated with the NEI-VFQ-25 subscales, which are less dependent on VA, including the general health and ocular pain subscales. The absence of a significant increase in general health scores can be assumed to be due to patients not evaluating their cataracts as negative in terms of their general health. Insignificant ocular pain score changes might be due to the unremarkable impact of cataract on ocular pain. The area related to driving may not reflect statistical analysis because more than half of the patients could not drive. We also used the FIM instrument to assess the functional recovery ability, which might be unique to our study regarding cataract surgery's impact on QOL. However, we did not observe a significant difference between the preoperative and postoperative FIM ratings ($p = 0.62$).

To examine the differential validity of the NEI-VFQ-25, we divided the patients into five groups. First, we classified the patients according to their BCVA (in decimal) levels, and we found a correlation between a lower preoperative NEI-VFQ-25 score (composite and all subscale scores except for general health, ocular pain, and driving) and a poorer preoperative BCVA. We evaluated the patients according to gender, and we found similar mean preoperative and postoperative NEI-VFQ-25 composite and subscale scores between male and female patients. We also assessed the patients according to their age range, and the mean preoperative and postoperative NEI-VFQ-25 composite and subscale scores obtained from the patients below 65 were found to be similar to the patients above 65. In the analysis of laterality, we noted lower preoperative NEI-VFQ-25 scores (composite and all subscale scores except for general health, ocular pain, driving, and color vision) in bilateral cases compared with unilateral cases. We divided the patients into two subgroups according to education level; we found that the mean preoperative NEI-VFQ-25 scores (composite and all subscale scores except for general health, ocular pain, and driving) were significantly lower in the highly educated patients. The changes between the preoperative and postoperative NEI-VFQ-25 composite scores were greater in patients with high education levels, bilateral phacoemulsification, and poorer BCVA than in patients with low education levels, unilateral phacoemulsification, and better BCVA. From these results, we think that the preoperative NEI-VFQ-25 scores are mainly affected by the BCVA levels regardless of gender and age. However, education level can also affect the preoperative

NEI-VFQ-25 scores even if the baseline BCVA levels are similar. This might be explained by people with higher education levels being able to feel and state the cataract-based QOL deficiencies earlier and better. The differences in the preoperative NEI-VFQ-25 scores between the unilateral and bilateral cases were probably due to the impact of the sum of VA in both eyes.

In a population-based longitudinal study, similar to our results, McKean *et al.* reported a correlation between VA and NEI-VFQ-25 scores, indicating that the deterioration in NEI-VFQ-25 scores is associated with the visual indices that reflect the condition of the patients' eye disease.¹⁷ Consistent with the results of our study, Hiratsuka *et al.* and Bayraktar *et al.* reported that postoperative improvements in the VFQ scores were related to visual improvements regardless of poorer or better VA levels.^{18,19} In our study, the improvement in the NEI-VFQ-25 scores after the phacoemulsification surgery was associated with a lower preoperative NEI-VFQ-25 score and poorer preoperative BCVA. Consistent with our analysis, a recent study also reported that a poorer preoperative NEI-VFQ-25 score was associated with a greater improvement in postoperative NEI-VFQ-25 scores, and the coefficients for preoperative NEI-VFQ-25 subscale scores were larger than those for the VA scales, which indicates that the preoperative NEI-VFQ-25 subscale scores are better predictors for the postoperative NEI-VFQ-25 scores than the VA scales.²⁰ In contrast to our results, in a 5-year study, Lundqvist *et al.* have shown that the QOL related to the visual function of the patients has a close relationship with gender.²¹ Also different from our outcomes, another study found that the mean composite score of female patients was lower before the surgery despite the similar baseline mean VA levels to male patients.²² In the recent study, few preoperative NEI-VFQ-25 subscales were influenced by gender: men accounted for high distance activities and driving scores.²⁰ Some studies reported that the QOL related to visual function showed a significant decrease with age (64 and above), which also did not correspond with our outcomes.^{22,23} In the recent study, a negative relationship was found between increasing age and some NEI-VFQ-25 subscales.²⁰ This discrepancy regarding age might be due to the older patient population, a decline in social functions with age, or the presence of ocular diseases other than cataract. In accordance with our findings, a previous cohort study reported that bilateral cataract surgery may provide VR-QOL

benefits beyond those observed with unilateral surgery.²⁴ Although the authors reported that the NEI-VFQ-25 scores improved following the first eye surgery and decreased over time before the second eye surgery, we did not measure the NEI-VFQ-25 scores between the first and second eye phacoemulsification surgery. In contrast to our results, one study reported that less-educated patients had significantly lower scores in the composite score assessment and the areas of general vision, vision-related social interaction, role difficulties, and dependence than more-educated patients.¹⁹

VR-QOL may be influenced not only by VA but also by other quality-of-vision factors, including contrast sensitivity, aberration, stereoscopic vision, dominant eye, depressive state, cognitive function, and postural control.^{25–27} Regarding these factors accounting for the limitations of our study, further studies with larger sample sizes are warranted for the assessment of VR-QOL. No sufficient power calculation was performed for FIM rating analyses, which should also be included as a limitation of the study.

In conclusion, phacoemulsification improved the VR-QOL of the patients with cataract and decreased the disparity in the postoperative VR-QOL among the patients regardless of unilateral or bilateral surgery. The VR-QOL was associated with the VA, but this relationship cannot be explained by the VA alone. To define the efficacy of the surgery, both VA and VR-QOL parameters should be measured. As a valid and reliable scale, the NEI-VFQ-25 can be used to evaluate the visual functions and psychosocial features of the cataract patients before and after the surgery. Smaller postoperative standard deviations of the NEI-VFQ-25 scores suggested the disparity-reducing effect of the phacoemulsification surgery in VR-QOL. Variations in the preoperative BCVA values caused by cataracts seemed to become approximately uniform after the phacoemulsification surgery treatment. BCVA level, laterality, and education level played an important role in assessing patients' QOL related to visual function.

Author contributions

Cetin Akpolat: Conceptualization; Methodology; Writing-original draft; Writing-review & editing.

Mehmet Demir: Investigation; Project administration; Resources; Supervision; Validation.

Seval Cevher: Investigation; Methodology.

Sibel Zorlu Ozturk: Methodology; Software; Supervision; Visualization.

Sumeyra Yesiltas: Data curation; Investigation.

Conflict of interest statement

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Ethics statement

This study followed the tenets of the Declaration of Helsinki. The institutional review board of Sisli Hamidiye Etfal Training and Research Hospital approved the study protocol (#-2195), and all patients gave informed consent forms before the phacoemulsification surgery to undergo cataract surgery and to participate in this study.

ORCID iD

Cetin Akpolat  <https://orcid.org/0000-0002-7443-6902>

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