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ARTICLE

Effect of cataract surgery on vision-related quality of life among cataract patients with high myopia: a prospective, case-control observational study

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OBJECTIVES: To evaluate the effect of cataract surgery on vision-related quality of life (VR-QOL) in cataract patients with high myopia (HM).

METHODS: In this prospective study, 90 patients with bilateral HM (HM group, mean [SD] age, 62.9 [9.7] years) and 90 age-matched patients with normal axial lengths (ALs) (control group) who underwent phacoemulsification surgery were consecutively included. The VR-QOL was evaluated using the 25-item National Eye Institute Visual Function Questionnaire (NEI-VFQ-25) preoperatively and 6 months postoperatively. During the same periods, the best-corrected visual acuity (BCVA) was recorded.

RESULTS: Postoperatively, the BCVA improved significantly in the HM group, with 78 patients (86.7%) achieving improvements ≥0.2 logMAR units, higher than that in the control group (61.1%, $P < 0.001$). Although the preoperative NEI-VFQ-25 composite score was lower in the HM group than in the control group (65.8 ± 4.7 [95% CI] versus 77.3 ± 3.8, $P < 0.001$), the postoperative composite score was not significantly different between the two groups (87.5 ± 2.6 versus 90.4 ± 1.6, $P = 0.126$); changes in composite score and scores of 7 subscales were greater in the HM group than in the control group ($P < 0.05$ for all). In the HM group, but not in the control group ($r = -0.019$, $P = 0.860$), patient age was negatively associated with the change in composite score ($r = -0.235$, $P = 0.026$). Preoperative BCVA (logMAR) was positively associated with changes in composite score for both groups ($r = 0.796$ and 0.714, respectively, $P < 0.001$ for both).

CONCLUSIONS: VR-QOL is significantly impaired in cataract patients with HM and is remarkably improved by cataract surgery. The improvement is greater than that in normal AL cases.

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INTRODUCTION

High myopia and cataracts are major causes of blindness worldwide, especially in East Asia [1]. High myopia is a significant risk factor for both cataract development and cataract surgery, with a 3.8-fold increase in the odds for nuclear cataracts [2], and a 4.81-fold increase in the odds for cataract surgery [3]. The prevalence of high myopia in cataract surgery patients has shown an upward trend accompanied by a significant increase in the number of high-myopia patients globally [4]. In a recent study conducted by our team [5], a high ratio of high myopia (12.8%) was observed in Chinese cataract surgery candidates. The ultimate goal of cataract surgery is to improve patients' visual function and, eventually, their quality of life (QOL) [6]. Indeed, vision-related QOL (VR-QOL) is the top concern for many cataract patients, and there is much evidence that cataracts not only impair visual function but also affect daily life activities in many ways [7–9]. For general patients, other than good postoperative visual acuity (VA), cataract surgery has been shown to substantially increase VR-QOL [10, 11]. Due to advances in phacoemulsification techniques, biometric devices and intraocular lens (IOL) power calculations, cataract surgery is routinely performed in high-myopia patients, and favourable postoperative VA has been observed in most cases [12, 13]. However, compared to those without high myopia, patients with high myopia have been found to have worse outcomes in terms of VA [14], and cataract surgery is significantly more challenging in highly myopic eyes than in eyes with normal axial lengths (ALs), with significantly higher incidences of unpredictable refractive errors and perioperative complications [15, 16]. Moreover, high-myopia patients have higher expectations for postoperative visual function because they suffer cataracts at a younger age and need cataract surgery significantly earlier than those without high myopia [3, 17, 18]. To the best of our knowledge, few studies have reported the functional visual outcomes of cataract surgery in high-myopia patients, and the effect of cataract surgery for cataract patients with high myopia on VR-QOL remains unclear.

The purpose of this study was to evaluate the effect of cataract surgery on VR-QOL in cataract patients with high myopia, and to determine whether cataract surgery in high-myopia patients confers as much improvement in VR-QOL as surgery in cases with normal ALs.

PATIENTS AND METHODS

Study design

In this prospective study, cataract patients with bilateral high myopia scheduled for phacoemulsification and IOL implantation surgery at the

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Zhongshan Ophthalmic Center, Sun Yat-sen University (Guangzhou, China), between August 2019 and January 2020 were consecutively enrolled. In the study, high myopia was defined as AL ≥ 26.0 mm [19, 20] and spherical equivalent (SE) ≤ −6.0 dioptres (D) [21, 22]. The primary inclusion criteria were the following: Chinese patients with bilateral cataracts, age of 30 years or older and absence of significant retinal disorders bilaterally, such as serious myopic maculopathy (≥ Category 3: patchy chorioretinal atrophy [23]). The exclusion criteria were the following: previous ocular surgery or trauma, ocular diseases other than refractive error, neurological/musculoskeletal deficits, or systemic diseases other than well-controlled type 2 diabetes mellitus and hypertension. Eligible patients with high myopia were included in the high-myopia group. During the same period at the Zhongshan Ophthalmic Center, eligible cases with normal ALs (defined as 22.0 ≤ AL ≤ 25.0 mm) [15, 24] and −3.0 ≤ SE ≤ + 3.0 D in both eyes were consecutively included in the control group. All participants underwent phacoemulsification surgeries performed by one experienced surgeon (M Wu). Patients in the two groups were also excluded if they had intraoperative complications or were unable to attend a follow-up visit 6 months postoperatively. The study was carried out under prospectively obtained approval by the Human Ethics Committee of the Zhongshan Ophthalmic Center (NO. 2019KYPJ124), and all procedures adhered to the tenets of the Declaration of Helsinki. Written informed consent was obtained from all participants included in the study.

Ophthalmic examinations and definitions

After collecting basic sociodemographic and relevant past medical history data, all patients underwent a routine ophthalmic examination preoperatively (baseline), including VA, refraction, intraocular pressure (IOP), slit-lamp and fundus examination through dilated pupils, corneal endothelial cell density, and B-scan ultrasonography. Six months postoperatively, VA, refraction, IOP, and slit-lamp and fundus examinations were assessed. VA was measured using the Early Treatment Diabetic Retinopathy Study (ETDRS) chart (Optec 6500, Stereo Optical Inc., Chicago, IL, USA) at a 4 m distance. ETDRS VA data were recorded as the logarithm of the minimal angle of resolution (logMAR) values, with additional conversions as follows: counting fingers = logMAR 2.2, hand movements = logMAR 2.5, and light perception = logMAR 3.0, modified by Holladay [25]. Best-corrected VA (BCVA) data in the better eye were used to represent the presenting visual status of the participants in this study. ALs were measured with an IOLMaster 700 (Carl Zeiss Meditec AG, Jena, Germany), and AL readings were feasible. Preoperative and postoperative refractive values were recorded as SE, calculated as the summation of the spherical refractive value and half of the cylindrical value. Postoperative complications, such as posterior capsule opacification (PCO) and retinal detachment (RD), were recorded at the follow-up visit.

VR-QOL questionnaires

The National Eye Institute 25-Item Visual Function Questionnaire (NEI-VFQ-25) is a VR-QOL instrument designed to assess patients' perception of their visual function and QOL [26]. This questionnaire consists of 25 items that assess patients' level of difficulty with particular visual symptoms or daily activities. Each item was assigned to 1 of 12 subscales: general health, general vision, ocular pain, near activities, distance activities, social functioning, mental health, role difficulties, dependency, driving, colour vision, and peripheral vision. The subscales are scored on a 0–100-point scale, with 100 indicating the highest possible function or minimal subjective impairment. The NEI-VFQ-25 composite score is calculated as the mean score of all subscales, except for general health [26].

The NEI-VFQ-25 used in this study was a Chinese version, with modifications to suit Chinese culture and lifestyle. The modified NEI-VFQ-25 has been assessed for reliability and validity, and it has been proven to accurately measure VR-QOL in Chinese cataract patients [27, 28]. VR-QOL of all patients enrolled in the study was evaluated in a face-to-face interview by one interviewer (Y Tan) preoperatively (baseline) and 6 months postoperatively. Furthermore, at the follow-up visit, all the participants were asked to rate their overall satisfaction with the outcomes of surgery on a five-category scale (very satisfied, satisfied, neither satisfied nor unsatisfied, dissatisfied, or very dissatisfied).

Statistical analysis

Data were analyzed using Excel 2010 (Microsoft Corp., Redmond, WA, USA) and SPSS 23.0 (IBM Corp., Armonk, NY, USA). The Kolmogorov–Smirnov test was used to assess the normal distribution of variables. Differences between the groups were compared using an independent *t*-test for normally distributed variables and a Mann–Whitney U test for nonnormally distributed variables. The paired *t*-test or Wilcoxon signed-rank test was performed to compare preoperative and postoperative data depending on the variable distributions. The χ2 test was applied to determine differences in categorical variables between the groups. The relationships between changes in NEI-VFQ-25 scores and preoperative parameters (sociodemographics, AL, SE, VA, and NEI-VFQ-25 scores) were analyzed using Spearman's rank correlation test. All *P* values were two-sided, and a *P* value <0.05 was considered statistically significant.

RESULTS

Sociodemographic and ophthalmic characteristics of the study participants

A total of 90 cataract patients (167 eyes) with high myopia (37 males and 53 females) aged 40–84 years (mean age, 62.9 years) were included in the high-myopia group. Ninety age-matched cases (156 eyes) with normal ALs were included in the control group. Table 1 shows the sociodemographic and ophthalmic characteristics of the study participants. Sex and sociodemographic variables other than education were not significantly different between the two groups ($P > 0.05$ for all). The mean AL and mean SE in the high-myopia group were 29.19 ± 2.15 (SD) mm and −14.86 ± 5.95 D, respectively, and both were significantly higher than those in the control group ($P < 0.001$ for both).

Changes in VA after cataract surgery

Postoperatively, the mean BCVA improved significantly in the two groups ($P < 0.001$ for both). Eighty-two patients (91.1%) in the high-myopia group and all patients in the control group achieved postoperative BCVA (logMAR) ≤ 0.3 (as ≥ 20/40 decimal acuity). In the high-myopia group, the mean change in BCVA (logMAR) was −0.49 ± 0.40 (SD), which was greater than that in the control group (−0.25 ± 0.19, $P < 0.001$), as shown in Fig. 1A. Additionally, in the high-myopia group, a ≥ 0.2 logMAR unit (equivalent to 2 ETDRS lines) improvement in BCVA was observed in 78 patients (86.7%), which was higher than the proportion in the control group (61.1%, $P < 0.001$), as shown in Fig. 1B.

The high-myopia patients were divided into two subgroups according to myopic severity based on the ALs: mild to moderate high myopia (defined as 26.0 ≤ AL < 30.0 mm [19, 29], $n = 58$) and extremely high myopia (defined as AL ≥ 30.0 mm [19, 29], $n = 32$). The mean BCVA significantly improved after surgery in both subgroups ($P < 0.001$ for both). The mean change in BCVA (logMAR) was similar between the two subgroups (−0.46 ± 0.37 versus −0.56 ± 0.45, $P = 0.243$), as shown in Fig. 1C. Forty-nine patients (84.5%) in the mild to moderate high-myopia subgroup and 29 patients (90.6%) in the extremely high-myopia subgroup showed improvements in BCVA ≥ 0.2 logMAR units; these improvements were not significantly different between the two subgroups ($P = 0.527$), as shown in Fig. 1D.

Changes in NEI-VFQ-25 scores after cataract surgery

The pre- and postoperative NEI-VFQ-25 scores are summarized in Table 2. The driving subscale data were not used in this analysis because only 14 patients (15.6%) in the high-myopia group and 18 patients (20.0%) in the control group drove. Cataract surgery in the two groups significantly improved the composite score ($P < 0.001$ for both) as well as the scores in 9 out of 11 subscales ($P < 0.05$ for all in each group), except for general health and ocular pain. Although the preoperative composite score in the high-myopia group was lower than that in the control group (65.8 ± 4.7 [95% CI] versus 77.3 ± 3.8, $P < 0.001$), the postoperative composite score was not significantly different between the two groups (87.5 ± 2.6 versus 90.4 ± 1.6, $P = 0.126$). Furthermore, the change in the composite score in the high-myopia group was greater than that in the control group (21.7 ± 4.0 versus 13.0 ± 3.6, $P = 0.001$). The

Table 1. Sociodemographic and ophthalmic characteristics of the study participants.

Parameter	High-myopia group ($n = 90$)	Control group ($n = 90$)	P value
Age (years)			
Mean ± SD	62.9 ± 9.7	64.7 ± 8.1	0.182[a]
Median (range)	65 (40, 84)	65 (40, 83)	
Sex, *n* (%)			
Male	37 (41.1)	38 (42.2)	1.000[b]
Female	53 (58.9)	52 (57.8)	
Surgical eye, *n* (%)			
Bilateral	77 (85.6)	66 (73.3)	0.064[b]
Unilateral	13 (14.4)	24 (26.7)	
Marital status, *n* (%)			
Married	88 (97.8)	89 (98.9)	1.000[b]
Unmarried, widowed, or divorced	2 (2.2)	1 (1.1)	
Education, *n* (%)			
High school or less	49 (54.4)	64 (71.1)	0.031[b]
College or more	41 (45.6)	26 (28.9)	
Employment status, *n* (%)			
Employed	28 (31.1)	26 (28.9)	0.871[b]
Unemployed or retired	62 (68.9)	64 (71.1)	
Attribution of housing, *n* (%)			
Own	63 (70.0)	68 (75.6)	0.503[b]
Did not own	27 (30.0)	22 (24.4)	
Area of residence, *n* (%)			
Rural	3 (3.3)	4 (4.4)	1.000[b]
Urban	87 (96.7)	86 (95.6)	
Personal annual income, *n* (%)			
<50,000 RMB	43 (47.8)	50 (55.6)	0.371[b]
≥50,000 RMB	47 (52.2)	40 (44.4)	
Axial length (mm)[d]			
Mean ± SD	29.19 ± 2.15	23.43 ± 0.72	<0.001[c]
Median (range)	28.96 (26.05, 34.49)	23.44 (22.06, 24.91)	
Spherical equivalent (dioptres)[d]			
Mean ± SD	−14.86 ± 5.95	−0.76 ± 1.52	<0.001[c]
Median (range)	−14.19 (−28.00, −6.00)	−0.69 (−3.00, 2.75)	
Intraocular pressure (mm Hg)[d]			
mean ± SD	12.31 ± 3.05	12.09 ± 2.86	0.755[c]
Median (range)	11.85 (7.3, 20.0)	11.70 (7.0, 19.0)	

SD standard deviation, *RMB* Renminbi.
[a]Independent *t*-test.
[b]$\chi 2$ test.
[c]Mann–Whitney U test.
[d]Data from the first-operated eye were selected for analysis.

change in scores was greater in the high-myopia group than in the control group for 7 of 11 subscales ($P < 0.05$ for all) but not for general health, ocular pain, colour vision, or peripheral vision.

Table 3 shows the pre- and postoperative NEI-VFQ-25 scores in the two high-myopia subgroups. Postoperatively, the composite score significantly increased in the two subgroups ($P < 0.001$ for both). Although the postoperative composite score in the extremely high-myopia subgroup was lower than that in the mild to moderate high-myopia subgroup (81.5 ± 5.9 versus 90.8 ± 2.0, $P < 0.001$), the change in the composite score in the extremely high-myopia subgroup was greater than that in the mild to moderate high-myopia subgroup (27.6 ± 6.6 versus 18.4 ± 4.9, $P = 0.016$).

Preoperative factors associated with changes in NEI-VFQ-25 composite scores

In the high-myopia group, patient age and preoperative SE were negatively associated with changes in NEI-VFQ-25 composite scores ($r = -0.235$, $P = 0.026$ and $r = -0.459$, $P < 0.001$, respectively). AL was positively associated with changes in the composite score ($r = 0.307$, $P = 0.003$). However, these three parameters were not significantly correlated with changes in composite scores in the control group ($P = 0.860$, $P = 0.566$, and $P = 0.432$, respectively). Preoperative BCVA (logMAR) was positively associated with changes in the composite score in the two groups ($r = 0.796$ and $r = 0.714$, respectively, $P < 0.001$ for both). The preoperative composite score was negatively associated with changes in the composite score in the two groups ($r = -0.844$ and $r = -0.891$, respectively, $P < 0.001$ for both). Sex and other sociodemographic parameters were not significantly correlated with changes in composite scores in the two groups ($P > 0.05$ for all).

Overall satisfaction and complications after cataract surgery

Figure 2 shows the overall levels of satisfaction with the outcomes of cataract surgery in the study participants. Satisfaction levels were high in the two groups; specifically, 83 patients (92.2%) in the high-myopia group and 75 patients (83.3%) in the control group were very satisfied or satisfied with the outcomes of surgery, which was not a significant difference ($P = 0.110$). However, in the high-myopia group, 21 patients (23.3%) were very satisfied with the outcomes of surgery, which was significantly higher than the proportion in the control group (7.8%, $P = 0.007$). At the follow-up visit, 12 eyes (7.2%) in the high-myopia group and 4 eyes (2.6%) in the control group had PCO and received Nd:YAG laser capsulotomy. No endophthalmitis or RD occurred in either group during the follow-up.

DISCUSSION

In this prospective, case-control study, we found that cataract surgery significantly improved not only VA but also VR-QOL in cataract patients with high myopia. The BCVA improved from 0.62 (logMAR) preoperatively to 0.13 (logMAR) postoperatively, and the NEI-VFQ-25 composite score increased from 65.8 preoperatively to 87.5 postoperatively. Compared with normal AL cases, significantly greater improvements in both BCVA and NEI-VFQ-25 composite scores after surgery (as benefits of cataract surgery) were observed in high-myopia patients.

Several retrospective studies have reported that good outcomes in terms of VA were achieved for patients with high myopia after cataract surgery [12, 13, 29], with 71.2% of eyes achieving postoperative BCVA ≥ 20/40 and 61.5% of eyes gaining ≥ 4 Snellen line improvements in a Taiwanese cohort [12]. However, compared to patients without high myopia, cataract patients with high myopia experienced worse postoperative visual performance [14]. Moreover, high-myopia patients have higher expectations for postoperative visual function and QOL because they tend to undergo cataract surgery at a significantly younger age [17, 18], and have higher incidences of anxiety and depression disorders than those without high myopia [30]. However, the effect of cataract surgery on VR-QOL in high-myopia patients has not yet been investigated systematically. In addition to the objective VA measurements, VR-QOL assessments provide more information, such as the effect on psychological function and daily activity [7, 9]. Therefore, with the increasing demand for better

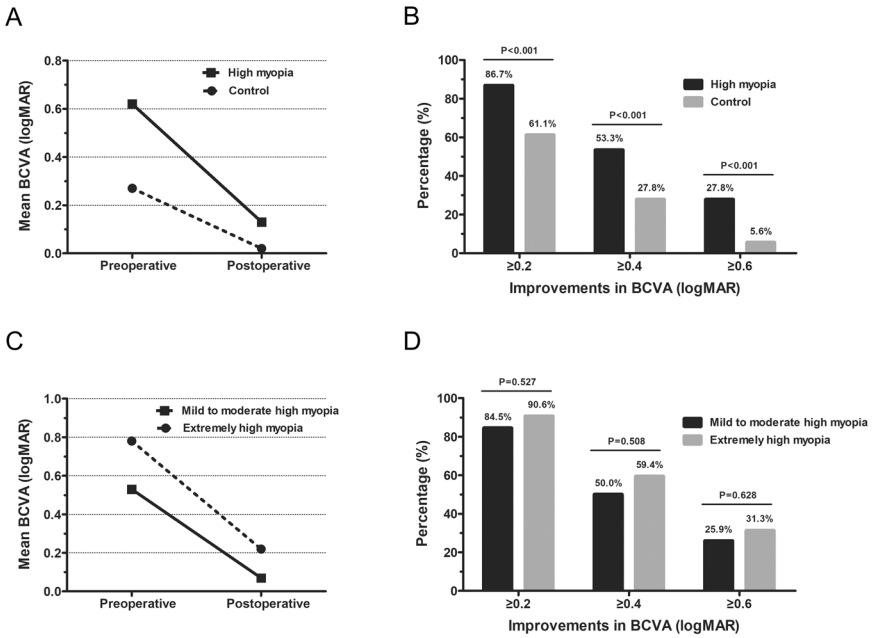

Fig. 1 Changes in best-corrected visual acuity (BCVA) after cataract surgery. A Line chart for visualizing the changes in mean BCVA (logMAR) after surgery in the high-myopia and control groups ($n = 90$ for each group). **B** Comparisons of three categories of BCVA improvements according to logMAR units between the two groups. **C** Line chart showing pre- and postoperative BCVA (logMAR) in the two high-myopia subgroups: mild to moderate high myopia ($n = 58$) and extremely high myopia ($n = 32$). **D** Comparisons of BCVA improvements according to logMAR units between the two high-myopia subgroups.

postoperative visual function and QOL, it is important to evaluate the effect of cataract surgery for high-myopia patients on VR-QOL to provide valuable information for clinical practice.

Our results show that cataract surgery yielded good visual outcomes in most cases with high myopia. A total of 91.1% of patients achieved postoperative BCVA (logMAR) ≤ 0.3 (as ≥ 20/40 decimal acuity), and 53.3% of patients gained ≥ 4 ETDRS line improvements, which was consistent with previous studies [12, 13]. Although the postoperative BCVA (logMAR) in the high-myopia patients was worse than that in patients with normal ALs (0.13 versus 0.02, $P < 0.001$), there was no clinically relevant difference, as the postoperative BCVA difference (0.11) was less than 0.2 logMAR units of acuity [31]. Comparing the BCVA (logMAR) changes from baseline to follow-up, the high-myopia patients demonstrated significantly greater improvements than cases with normal ALs (0.49 versus 0.25, $P < 0.001$). The encouraging visual outcomes in high-myopia patients should be attributed to their relatively good fundus condition without significant retinal disorders preoperatively. These findings suggest that a greater VA benefit can be gained in patients with high myopia after surgery than in patients with normal ALs.

To obtain a more complete picture of the effect of cataract surgery in cataract patients with high myopia, we assessed VR-QOL outcomes using the NEI-VFQ-25 in addition to traditional objective VA measurements. Cataract surgery for high-myopia patients resulted in improved composite scores (from 65.8 preoperatively to 87.5 postoperatively), and 9 subscales significantly improved postoperatively ($P < 0.001$ for all), especially those related to distance activities, mental health, and dependency. Interestingly, although cases with normal ALs had better postoperative BCVA in this study, the two groups reported similar composite scores postoperatively (87.5 versus 90.4, $P = 0.126$); that is, the patients' perceptions of their VR-QOL were similar, which was consistent with the findings in a previous study on patients with extreme myopia [14]. This result could be attributed to the poor visual status preoperatively in cataract patients with high myopia who always had poor visual function and QOL before surgery. Moreover, compared to patients with normal ALs, patients with high myopia gained greater increases in composite scores from baseline to follow-up (21.7 versus 13.0, $P = 0.001$). According to the current findings, cataract surgery confers a greater benefit in VR-QOL in high-myopia patients than in those with normal ALs. This should be attributed to cataract surgery solving both visual and refractive problems in patients with cataracts and high myopia [15].

In our study, improvements in VR-QOL were negatively associated with age among patients with high myopia ($r = -0.235$, $P = 0.026$) but not significantly associated with age among patients with normal ALs. Therefore, a more supportive attitude toward early cataract surgery may be suggested, especially in cases with high myopia. Additionally, the baseline ALs in the high-myopia patients were positively associated with improvements in VR-QOL ($r = 0.307$, $P = 0.003$), which was consistent with our results of increases in NEI-VFQ-25 composite scores according to myopic severity. This result is attributed to the removal of the cataract along with the correction of the refractive errors during cataract surgery for cataract patients with high myopia [15].

Overall levels of satisfaction with the outcomes of cataract surgery were very high (92.2%) in the high-myopia patients. This was a relatively small series, but no significant surgical complications occurred in the 90 consecutive cases studied. Specifically, there were no cases of RD. Despite the relatively small sample size, highly significant differences between cases with high myopia and normal ALs were identified with respect to changes in BCVA, overall NEI-VFQ-25 scores and most of the NEI-VFQ-25 individual subscales, especially regarding improvements in mental health, which is commonly impaired among high-myopia patients [30].

There are several limitations of our study. First, the driving subscale data were not included in the analysis because of the low response rate, which may influence the NEI-VFQ-25 composite score and VR-QOL. Second, pre- and postoperative subjective refractions were not performed by a single optometrist, which

Table 2. Changes in NEI-VFQ-25 subscale and composite scores in the high-myopia and control groups.

NEI-VFQ-25 Scale	High-myopia group ($n = 90$)				*P* value[b]	Control group ($n = 90$)				*P* value[c]	*P* value[d]
	Preoperative	Postoperative	*P* value[a]	Change		Preoperative	Postoperative	*P* value[a]	Change		
General health	43.9 (2.3)	45.3 (2.2)	0.400	1.4 (1.4)	0.790	46.1 (2.7)	47.8 (2.6)	0.365	1.7 (1.5)	0.275	0.171
General vision	42.0 (4.3)	76.4 (3.1)	<0.001	34.4 (4.2)	0.003	53.1 (3.8)	78.2 (2.0)	<0.001	25.1 (4.2)	<0.001	0.676
Ocular pain	78.2 (2.5)	79.7 (1.9)	0.206	1.5 (2.6)	0.669	78.8 (3.0)	81.3 (2.4)	0.114	2.5 (3.2)	0.659	0.120
Near activities	67.8 (6.2)	89.2 (3.0)	<0.001	21.3 (5.7)	0.020	82.2 (4.2)	92.3 (2.4)	0.001	10.1 (4.1)	0.001	0.139
Distance activities	57.6 (5.8)	92.0 (3.1)	<0.001	34.4 (5.2)	<0.001	74.5 (4.8)	94.5 (2.1)	<0.001	20.0 (4.7)	<0.001	0.401
Social functioning	79.4 (5.6)	97.5 (1.9)	<0.001	18.1 (5.2)	0.021	89.7 (3.3)	98.9 (0.7)	<0.001	9.2 (3.2)	0.019	0.575
Mental health	43.1 (6.1)	77.2 (4.8)	<0.001	34.1 (5.4)	<0.001	64.0 (6.3)	82.7 (3.4)	<0.001	18.7 (6.2)	<0.001	0.312
Role difficulties	58.8 (4.6)	78.5 (3.8)	<0.001	19.7 (4.1)	0.001	74.2 (4.2)	83.3 (3.0)	0.002	9.2 (4.3)	<0.001	0.092
Dependency	65.3 (7.0)	92.7 (3.5)	<0.001	27.4 (5.9)	0.001	80.6 (5.6)	96.8 (1.4)	<0.001	16.2 (5.5)	<0.001	0.245
Driving	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Colour vision	86.1 (5.3)	98.1 (2.1)	<0.001	11.9 (4.9)	0.501	90.8 (3.6)	99.2 (0.9)	<0.001	8.3 (3.6)	0.430	0.682
Peripheral vision	79.7 (5.8)	93.6 (2.9)	<0.001	13.9 (4.8)	0.546	85.3 (4.4)	96.4 (2.0)	<0.001	11.1 (4.3)	0.288	0.157
Composite score	65.8 (4.7)	87.5 (2.6)	<0.001	21.7 (4.0)	0.001	77.3 (3.8)	90.4 (1.6)	<0.001	13.0 (3.6)	<0.001	0.126

Data are presented as mean (95% confidence interval, 95% CI).
NEI-VFQ-25 National Eye Institute 25-Item Visual Function Questionnaire, *N/A* not applicable.
[a]Comparison between pre- and postoperative NEI-VFQ-25 score.
[b]Comparison between two groups on the change in NEI-VFQ-25 score.
[c]Comparison between two groups on the preoperative NEI-VFQ-25 score.
[d]Comparison between two groups on the postoperative NEI-VFQ-25 score.

Table 3. Changes in NEI-VFQ-25 subscale and composite scores in the patients with high myopia, according to myopic severity.

NEI-VFQ-25 Scale	Mild to moderate high myopia ($n = 58$)				*P* value[b]	Extremely high myopia ($n = 32$)				*P* value[c]	*P* value[d]
	Preoperative	Postoperative	*P* value[a]	Change		Preoperative	Postoperative	*P* value[a]	Change		
General health	43.1 (3.0)	44.8 (2.7)	0.388	1.7 (1.7)	0.549	45.3 (3.6)	46.1 (4.0)	0.803	0.8 (2.8)	0.353	0.625
General vision	46.2 (5.2)	80.7 (2.6)	<0.001	34.5 (5.3)	0.902	34.4 (7.1)	68.8 (6.8)	<0.001	34.4 (7.1)	0.009	<0.001
Ocular pain	80.0 (3.3)	81.3 (2.6)	0.419	1.3 (3.7)	0.839	75.0 (3.6)	76.2 (1.8)	0.456	1.2 (3.9)	0.035	0.004
Near activities	77.4 (6.9)	91.2 (2.8)	0.016	13.9 (6.8)	<0.001	50.5 (9.8)	85.4 (7.0)	<0.001	34.9 (9.2)	<0.001	0.388
Distance activities	64.7 (6.8)	95.3 (2.5)	<0.001	30.5 (6.4)	0.040	44.8 (9.5)	86.2 (7.5)	<0.001	41.4 (8.7)	0.001	0.018
Social functioning	85.6 (5.9)	98.9 (0.9)	<0.001	13.4 (5.8)	0.006	68.4 (10.9)	94.9 (5.1)	<0.001	26.6 (9.8)	0.002	0.262
Mental health	52.8 (7.4)	83.9 (4.8)	<0.001	31.2 (7.2)	0.102	25.4 (8.0)	64.8 (9.3)	<0.001	39.5 (7.9)	<0.001	<0.001
Role difficulties	65.5 (5.9)	83.8 (3.7)	<0.001	18.3 (5.5)	0.320	46.5 (5.6)	68.8 (7.3)	<0.001	22.3 (6.3)	<0.001	<0.001
Dependency	73.6 (8.1)	96.4 (2.6)	<0.001	22.8 (7.2)	0.014	50.3 (12.2)	85.9 (8.5)	<0.001	35.7 (10.3)	0.001	<0.001
Driving	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Colour vision	91.4 (5.2)	99.6 (0.9)	0.001	8.2 (5.0)	0.058	76.6 (11.4)	95.3 (5.8)	0.002	18.8 (10.5)	0.012	0.089
Peripheral vision	86.6 (5.7)	96.6 (2.3)	0.005	9.9 (5.8)	0.022	67.2 (11.8)	88.3 (6.9)	0.004	21.1 (8.6)	0.002	0.016
Composite score	72.4 (5.3)	90.8 (2.0)	<0.001	18.4 (4.9)	0.016	53.9 (8.1)	81.5 (5.9)	<0.001	27.6 (6.6)	<0.001	<0.001

Data are presented as mean (95% confidence interval, 95% CI).
NEI-VFQ-25 National Eye Institute 25-Item Visual Function Questionnaire, *N/A* not applicable.
[a]Comparison between pre- and postoperative NEI-VFQ-25 score.
[b]Comparison between two subgroups on the change in NEI-VFQ-25 score.
[c]Comparison between two subgroups on the preoperative NEI-VFQ-25 score.
[d]Comparison between two subgroups on the postoperative NEI-VFQ-25 score.

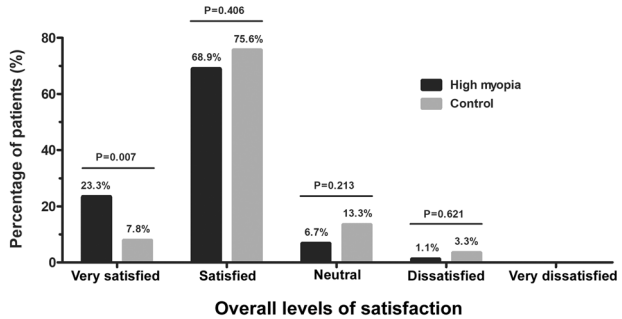

Fig. 2 Bar graph showing overall levels of patient satisfaction after cataract surgery in the two groups. All participants in the two groups were asked to grade overall satisfaction with the surgery on a 5-category scale. Twenty-one patients (23.3%) in the high-myopia group and seven patients (7.8%) in the control group were very satisfied with the outcomes of surgery; 62 patients (68.9%) in the high-myopia group and 68 patients (75.6%) in the control group were satisfied with the outcomes of surgery.

may cause measurement errors and influence the relationship between BCVA and NEI-VFQ-25 scores. However, the uniform training in the Zhongshan Ophthalmic Center may minimize the impact of this bias on this study. Third, because all of the participants were Chinese patients, comparable studies in other countries or ethnic groups are necessary to assess the generalizability of our findings. Fourth, although most of the participants had bilateral surgery, the unilateral surgery patients may influence the VR-QOL difference between the two groups.

In conclusion, the present study evaluated the effect of cataract surgery on VR-QOL in cataract patients with high myopia and compared it with normal AL cases. Other than good postoperative VA, significant improvements in VR-QOL and a high level of patient satisfaction were observed in cases with high myopia after surgery. Moreover, the improvements in both BCVA and VR-QOL after surgery in high-myopia patients were significantly greater than those in cases with normal ALs. Our results may provide a valuable reference for surgeons to develop therapeutic scenarios for cases with high myopia based on the expectation of the benefit of undergoing cataract surgery and will give those with high myopia more confidence to undergo cataract surgery.

SUMMARY

What was known before

- Cataracts not only impair visual function but also affect daily life activities in many ways. For general cataract patients, other than good postoperative visual acuity (VA), cataract surgery has been shown to substantially increase vision-related quality of life (VR-QOL).
- Cataract surgery is significantly more challenging in highly myopic eyes than in eyes with normal axial lengths (ALs); cataract patients with high myopia have higher expectations for postoperative visual function than those without high myopia. However, compared to those without high myopia, high-myopia patients have been found to have worse outcomes in terms of VA after cataract surgery.

What this study adds

- This study evaluated the effect of cataract surgery on VR-QOL in cataract patients with high myopia and compared it with normal AL cases. VR-QOL was significantly impaired in cataract patients with high myopia. After cataract surgery, significant improvements in VR-QOL and a high level of patient satisfaction were observed in cataract patients with high myopia. The improvements in both best-corrected VA and VR-QOL after cataract surgery in high-myopia patients were significantly greater than those in patients with normal ALs.

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AUTHOR CONTRIBUTIONS

(I) Conception and design: YT, MW; (II) Administrative support: MW; (III) Provision of study materials or patients: LL, YQ, AS, MW; (IV) Collection and assembly of data: LL, JL, YQ, AS; (V) Data analysis and interpretation: YT, LL, JL, MW; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

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COMPETING INTERESTS

The authors declare no competing interests.

ADDITIONAL INFORMATION

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