• Investigation •

Functional outcome and patient satisfaction 5y after laser vision correction

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Abstract

● **AIM:** To investigate the association between functional outcomes and postoperative patient satisfaction 5y after small incision lenticule extraction (SMILE) and femtosecond laser-assisted *in situ* keratomileusis (FS-LASIK).

● **METHODS:** This is a cross-sectional study. The patients underwent basic ophthalmic examinations, axial length measurement, wide-field fundus photography, and accommodation function testing. Behavioral habits data were collected using a self-administered questionnaire, and visual symptoms were assessed with the Quality of Vision (QoV) questionnaire. Postoperative satisfaction was also recorded.

● **RESULTS:** Totally 410 subjects [820 eyes, 160 males (39.02%) and 250 females (60.98%)] who had undergone SMILE or FS-LASIK 5y ago were enrolled. The mean (standard deviation, SD) age of all patients was 29.83y (6.69). The mean (SD) preoperative manifest SE was -5.80 (2.04) diopters (D; range: -0.88 to -13.75). Patient satisfaction at 5y after undergoing SMILE or FS-LASIK was 91.70%. Patients were categorized into two groups: dissatisfied group and satisfied group. Significant differences were observed between the two groups in terms of age (P=0.012), sex (P=0.021), preoperative degree of myopia (P=0.049), postoperative visual symptoms (frequency, P=0.043; severity, P<0.001; bothersome, P=0.018), difficulty driving at night (P=0.001), and accommodative amplitude (AMP, P=0.020). Multivariate analysis confirmed that female sex (P=0.024), severity of visual symptoms (P=0.009), and difficulty driving at night (P=0.006) were significantly associated with lower satisfaction. The dissatisfied group showed higher rates of starbursts, double or multiple images, and high myopia, but lower age. The frequency, severity, and bothersome of distortion exhibited decreased with increasing age.

● **CONCLUSION:** Patient satisfaction 5y after SMILE and FS-LASIK is high and stable. Difficulty driving at night, sex, and severity of visual symptoms are important factors influencing patient satisfaction. Special attention should be paid to younger highly myopic female patients, particularly those with starbursts and double or multiple images. It is crucial to monitor postoperative visual outcomes and provide patients with comprehensive preoperative counseling to enhance long-term satisfaction.

● **KEYWORDS:** patient satisfaction; myopia; vision; small incision lenticule extraction; femtosecond laser-assisted *in situ* keratomileusis

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INTRODUCTION

Uncorrected refractive error is the leading cause of global visual impairment, and myopia is the most common type of refractive error[1]. The prevalence of myopia and high myopia has been increasing worldwide. By 2050, it is predicted that nearly 5 billion people will be affected by myopia and approximately 1 billion by high myopia[2]. Changes in lifestyle, education, and demographics suggest that the global prevalence of myopia and high myopia will continue to rise. These trends have significant implications for the planning of comprehensive eye care services, particularly for those with high myopia[2].

Laser vision correction (LVC) is one of the most commonly performed refractive procedures. Over the past decades, LVC has witnessed significant advances in the safety, efficacy and predictability of surgical outcomes[3-7]. In recent years, femtosecond-assisted procedures such as small incision lenticule extraction (SMILE), which is flapless[8], and femtosecond laser *in-situ* keratomileusis (FS-LASIK), which

involves corneal flap creation[9], have gained popularity among LVC procedures.

Patient-reported outcome questionnaires have become an increasingly popular method of assessing subjective quality of vision after refractive surgery[4,10-13]. These questionnaires evaluate common visual complaints reported after corneal refractive surgery, including glare, halos, starbursts, *etc*[14]. Patients undergoing LVC may experience additional symptoms that can significantly affect their satisfaction with the procedure. Demographics and lifestyle factors, such as occupation, hobbies, and sports can also modulate an individual's satisfaction. After surgery, the change from myopia to emmetropia results in a more precise accommodative response. However, while there is a significant decrease in the amplitude of accommodation, the lag of accommodation is significantly lower compared to preoperative levels; the postoperative lag of accommodation may be a valuable predictor of myopic regression after surgery[15]. It remains unclear how accommodative parameters change over time and whether these changes affect long-term patient satisfaction.

Current evaluations of postoperative visual quality predominantly focus on visual acuity and optical measurements. However, some patients without excellent optical performance may express great satisfaction with visual quality, while those who obtained perfect optical results may have severe visual complaints. This inconsistency makes the study of postoperative patient satisfaction particularly important. Several studies have indicated that patient satisfaction may be associated with dry eye symptoms, visual acuity, postoperative astigmatism, and uncorrected vision[16-19]. However, none of the previous studies have investigated the relationship between subjective quality of vision, behavioral habits, accommodation, and patient satisfaction in myopic patients after long-term corneal refractive surgery. This study investigated the factors influencing patient satisfaction in individuals who underwent FS-LASIK or SMILE for myopic eyes.

PARTICIPANTS AND METHODS

Ethical Approval This study was approved by the Ethics Committee of Beijing Tongren Hospital, Capital Medical University (No.TRECKY2021-216; date of approval: January 18, 2022). All procedures adhered to the tenets of the Declaration of Helsinki. Written informed consent was obtained from all participants, and patients received complimentary ophthalmic examinations.

Study Design and Participants This cross-sectional observational study included patients who underwent SMILE or FS-LASIK at the Eye Center of Beijing Tongren Hospital from January 2015 to March 2018. The inclusion criteria were as follows: 1) corneal refractive surgery performed at least 5y ago; 2) best corrected visual acuity (BCVA) of 20/25 or better in both eyes; 3) preoperative myopic spherical equivalent (SE) between -0.50 D and -12.00 D; 4) stable myopia (myopic progression of 0.50 D or less per year or 1.00 D or less in two years before surgery); 5) discontinuation of soft contact lens wore for at least 2wk, rigid contact lens wore for at least 1mo and orthokeratology lens wore for at least 3mo before the preoperative evaluation[20]; 6) full correction in the initial surgery. Exclusion criteria were as follows: 1) ocular diseases including corneal ectasia, cataract, glaucoma, uveitis, *etc*; 2) anisometropia of ≥2.5 D; 3) dry eye symptoms, indicated by an ocular surface disease index (OSDI) score ≥13 and a tear break-up time (TBUT) ≤10s; 4) ocular injury or surgery except for the initial LVC surgery; 5) systemic diseases, such as connective tissue disorders, autoimmune diseases, severe diabetes, or mental illness; 6) pregnancy, breastfeeding or taking medications that affect accommodation. Participants were invited by telephone to undergo evaluation five years after surgery and voluntarily decided to participate. The study was conducted from January 2020 to March 2023.

Measurement and Questionnaire All patients underwent a thorough ophthalmic examination, including uncorrected distance visual acuity (UDVA, logMAR), corrected distance visual acuity (CDVA, logMAR), noncontact intraocular pressure, and subjective and objective refraction. Slit-lamp examination was performed to exclude ocular abnormalities. Axial length was measured using optical low-coherence reflectometry (LENSAR, LS 900, SN 3697, V2.1.0, Switzerland). Fundus images were captured using a panoramic wide-angle laser fundus camera (Ophthalmoscope-Daytona, P200T, Optos, UK) to exclude fundus disease. Macular thickness within the 1 mm zone was measured using RTVue-100 (Optovue, Inc., Fremont, USA) by a single trained investigator. Accommodation parameters were assessed by an experienced ophthalmologist using a phoropter, including positive relative accommodation (PRA), negative relative accommodation (NRA), binocular cross-cylinder (BCC) and accommodative amplitude (AMP). AMP was measured by the approach method. Near stereopsis was examined with the Titmus stereoscopic image (Stereo Optical, USA). All subjects underwent fluorescein TBUT measurement and completed a self-administered OSDI questionnaire to exclude dry eye. Data on age, sex, preoperative myopia and diameter of the optical zone were collected.

The Quality of Vision (QoV) questionnaire, developed by McAlinden *et al*[21], was used to assess 10 visual symptoms: glare, halos, hazy vision, starbursts, blurred vision, double or multiple images, distortion, fluctuation in vision, focusing difficulties, and difficulty judging distance or depth perception. Each symptom has 3 rating scales: frequency (0=never, 1=occasionally, 2=quite often, 3=very often), severity (0=not

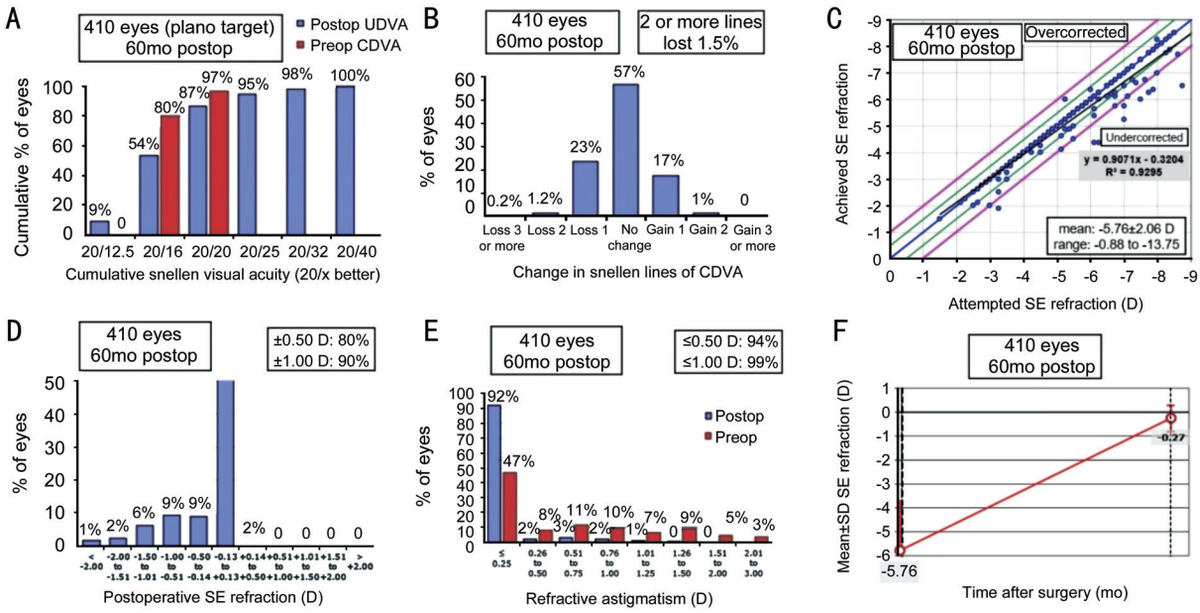

Figure 1 Six standard graphs for reporting refractive surgery showing the visual and refractive outcomes 60mo after SMILE and FS-LASIK A: UDVA; B: Change in CDVA; C: SE refraction attempted versus achieved; D: SE refractive accuracy; E: Refractive astigmatism; F: Stability of SE refraction. SMILE: Small incision lenticule extraction; FS-LASIK: Femtosecond laser-assisted *in situ* keratomileusis; UDVA: Uncorrected distance visual acuity; CDVA: Corrected distance visual acuity; D: diopters; Preop: Preoperative; Postop: Postoperative; SD: Standard deviation; SE: Spherical equivalent.

at all, 1=mild, 2=moderate, 3=severe), and bothersome (0=not at all, 1=a little, 2=quite, 3=very). An additional question assessed whether participants had difficulty driving at night. Postoperative satisfaction was assessed using a single item with 6 possible responses, ranging from "very dissatisfied" to "very satisfied" (0=very dissatisfied, 1=dissatisfied, 2=general, 3=less satisfied, 4=satisfied, 5=very satisfied). Based on these scores, patients were categorized into two groups: dissatisfied (scores 0-2) and satisfied (scores 3-5). Respondents indicating "general" were classified as dissatisfied to strictly define satisfaction in this study.

A self-administered behavioral questionnaire was used to collect information on the average time spent on near work and physical activities, the duration of near work, and whether to turn on the light while sleeping, use the screen, and do eye exercises (Chinese eye exercise, eye massage) each day[22-23]. Near work included reading, using computers or tablet, using smartphones, drawing and writing, *etc*. Physical activities included running, swimming, dancing, working out, walking, cycling, shopping, playing badminton, table tennis, basketball, football, *etc*. The SE was computed as sphere+0.5×cylinder.

Statistical Analysis IBM SPSS Statistics for Windows, version 26.0 (IBM Corp., Armonk, NY, USA) was used for statistical analysis. Measures are presented as mean±standard deviation (SD) for continuous variables and percentages for categorical variables. Questionnaire data were converted to numerical values for analysis. Exploratory analyses evaluated potential factors influencing satisfaction. Independent *t*-tests and Chi-squared tests were used to compare continuous and categorical variables, respectively. Binary logistic regression analysis was conducted to identify predictors of postoperative satisfaction. Two-sided $P<0.05$ was considered statistically significant.

RESULTS

Initially, 426 patients were enrolled; however, 5 were deemed ineligible due to anisometropia, and 11 were excluded owing to severe dry eye. Consequently, a total of 410 [160 males (39.02%) and 250 females (60.98%)], ranging in age from 18 to 46y at the time of surgery, were included in this study. Both eyes of each patient were examined. The patient satisfaction rate assessed 5y after either SMILE or FS-LASIK was 91.70%. Figure 1 presents standard graphs for reporting refractive surgery outcomes.

The characteristics of basic and subjective quality of vision in the two groups are shown in Table 1. Of these, 243 patients [486 eyes (59.27%)] underwent FS-LASIK, and 167 patients [334 eyes (40.73%)] underwent SMILE. The mean (SD) age of all patients was 29.83 (6.69)y. The mean (SD) preoperative manifest SE was -5.80 (2.04) D (range: -0.88 to -13.75). Postoperative satisfaction rates were 95.63% in males and 89.20% in females, and 89.82% after SMILE versus 93.00% after FS-LASIK. Satisfaction rates by age group were 85.22% in the 18-25 group, 94.29% in the 26-35 group, and 94.12% in the 36-46 group. There were no significant differences between satisfied group and dissatisfied group in preoperative CDVA (logMAR), preoperative SE, postoperative UDVA (logMAR),

Table 1 Characteristics of basic and subjective quality of vision in two groups mean±SD

Characteristic	Dissatisfied group	Satisfied group	*P*
Numbers of person, *n*	34	376	
Age at surgery, y	27.12±7.38	30.07±6.58	0.012[a]
18-25	17 (50.00)	98 (26.06)	
26-35	12 (35.29)	198 (52.66)	
36-46	5 (14.71)	80 (21.28)	
Sex, *n* (%)			0.021[a]
Male	7 (20.59)	153 (40.69)	
Female	27 (79.41)	223 (59.31)	
Procedure, *n* (%)			0.424
SMILE	17 (50.00)	150 (39.89)	
FS-LASIK	17 (50.00)	226 (60.11)	
Pre-CDVA (logMAR)	-0.09±0.04	-0.08±0.04	0.759
Pre-SE, D	-6.14±2.73	-5.77±1.97	0.392
Pre-degree of myopia, *n* (%)			0.049[a]
Mild myopia	2 (5.88)	16 (4.26)	
Moderate myopia	15 (44.12)	202 (53.72)	
High myopia	17 (50.0)	158 (42.02)	
Post-UDVA (logMAR)	-0.02±0.12	-0.04±0.12	0.633
Post-SE, D	-0.36±0.74	-0.27±0.58	0.435
Diameter of the optical zone (mm)	6.51±0.37	6.42±0.17	0.116
Axial length	25.79±1.10	25.87±1.11	0.693
Macular thickness (μm)	246.29± 9.25	246.48± 18.92	0.06
Frequency of visual symptoms	6.15±3.03	5.05±3.01	0.043[a]
Severity of visual symptoms	7.21±4.05	4.96±3.32	<0.001[a]
Bothersome of visual symptoms	4.88±3.44	3.63±2.89	0.018[a]
Difficulty driving at night, *n*	15	93	0.001[a]

SMILE: Small incision lenticule extraction; FS-LASIK: Femtosecond laser-assisted laser *in situ* keratomileusis; Pre: Preoperative; Post: Postoperative; UDVA: Uncorrected distance visual acuity; CDVA: Corrected distance visual acuity; SE: Spherical equivalent; D: Diopters; SD: Standard deviation. [a]*P*<0.05.

Table 2 Characteristics of behavioral habits and accommodation in two groups mean±SD

Characteristic	Dissatisfied group	Satisfied group	*P*
Numbers of person, *n*	34	376	
Continuous reading (min), *n* (%)			0.077
0 to 45	7 (20.59)	134 (35.64)	
46 to 120	27 (79.41)	242 (64.36)	
Total near work time (h/d), *n* (%)			0.618
≤4	8 (23.53)	64 (17.02)	
>4 and ≤8	8 (23.53)	103 (27.39)	
>8	18 (52.94)	209 (55.59)	
Physical activities (h/wk), *n* (%)			0.733
≤7	20 (58.82)	207 (55.05)	
>7 and ≤14	11 (32.35)	118 (31.38)	
>14	3 (8.82)	51 (13.56)	
Use screen, *n* (%)	30 (88.24)	341 (90.69)	0.640
Turn on the light during sleeping, *n* (%)	1 (2.94)	11 (2.93)	0.887
Do eye exercises, *n* (%)	7 (20.58)	66 (17.55)	0.901
NRA, *n* (%)			0.091
<1.75	5 (14.71)	65 (17.29)	
1.75-2.25	28 (82.35)	251 (66.76)	
>2.25	1 (2.94)	60 (15.96)	
PRA, D	-3.40±1.82	-3.34±1.54	0.848
BCC, *n* (%)			0.156
<0.25	4 (11.76)	57 (15.16)	
0.25-0.75	28 (82.35)	254 (67.55)	
>0.75	2 (5.88)	65 (17.29)	
AMP, D	10.35±3.33	11.86±4.95	0.020[a]
Near stereopsis, *n* (%)			0.224
≤60	22 (64.71)	187 (49.73)	
>60	12 (35.29)	185 (49.20)	
Beyond recognition	0	4 (1.06)	

NRA: Negative relative accommodation; PRA: Positive relative accommodation; D: Diopters; BCC: Binocular cross-cylinder; AMP: Accommodative amplitude; SD: Standard deviation. [a]*P*<0.05.

postoperative SE, optical zone diameter, axial length, or macular thickness. The average age of patients in the satisfied group was significantly higher than that in the dissatisfied group. Significant differences were found in the frequency (*P*=0.043), severity (*P*=0.000), and bothersome (*P*=0.018) of visual symptoms, difficulty driving at night (*P*=0.001) between two groups (Table 1). Table 2 presents the behavioral habits and accommodative function of the two groups. No significant differences were found in continuous reading, total near work time, physical activities, screen use, turn on the light during sleeping, do eye exercises, NRA, PRA, BCC, and near stereopsis. However, AMP was significantly lower in the dissatisfied group compared to the satisfied group (*P*<0.05; Table 2). The associations of the above statistically different variables and clinically relevant variables with postoperative patient satisfaction in binary logistic regression analysis are presented in Figure 2. The association between males and postoperative patient satisfaction was positively significant [odds ratio (OR): 2.646, 95% confidence interval (CI): 1.138 to 6.154; *P*=0.024]. Severity of visual symptoms (OR: 0.870; 95%CI: 0.784 to 0.966; *P*=0.009) and difficulty driving at night (OR: 0.302; 95%CI: 0.129 to 0.708; *P*=0.006) were negatively associated with postoperative patient satisfaction (Figure 2).

Significant differences were also observed between groups in the frequency (*P*=0.001) and severity (*P*=0.005) of starbursts and the severity (*P*=0.03) and bothersome (*P*=0.044) of double or multiple images (Figure 3). Characteristics of patients reporting difficulty with night driving are presented in Table 3. Among the population, the 48.15% were aged 36-46y, and over 50% were female or had high myopia. Rates of frequency, severity, and bothersome of visual symptoms were notably elevated. Fluctuating vision, halos, and distortion were significantly associated with night-driving difficulty (Figure 4). Subgroup analyses of visual symptoms by age illustrated statistically significant differences in three scales (frequency:

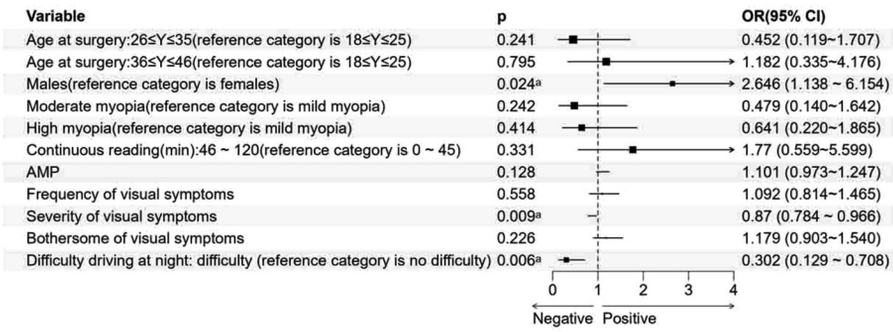

Figure 2 Forest plot of OR for the association of statistically different variables and clinically relevant variables with patient satisfaction after SMILE and FS-LASIK in binary logistic regression analysis Y: Years; AMP: Accommodative amplitude; OR: Odds ratio; SMILE: Small incision lenticule extraction; FS-LASIK: Femtosecond laser-assisted laser *in situ* keratomileusis; CI: Confidence interval. [a]*P*<0.05.

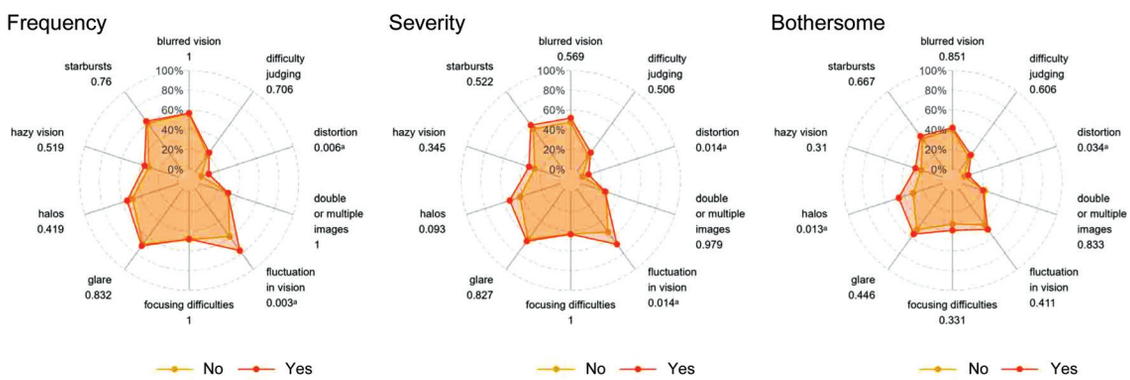

Figure 3 Spider plot representing the percentage of frequency, severity, and bothersome of each symptom in people in the satisfied and dissatisfied groups after SMILE and FS-LASIK SMILE: Small incision lenticule extraction; FS-LASIK: Femtosecond laser-assisted laser *in situ* keratomileusis. [a]*P*<0.05.

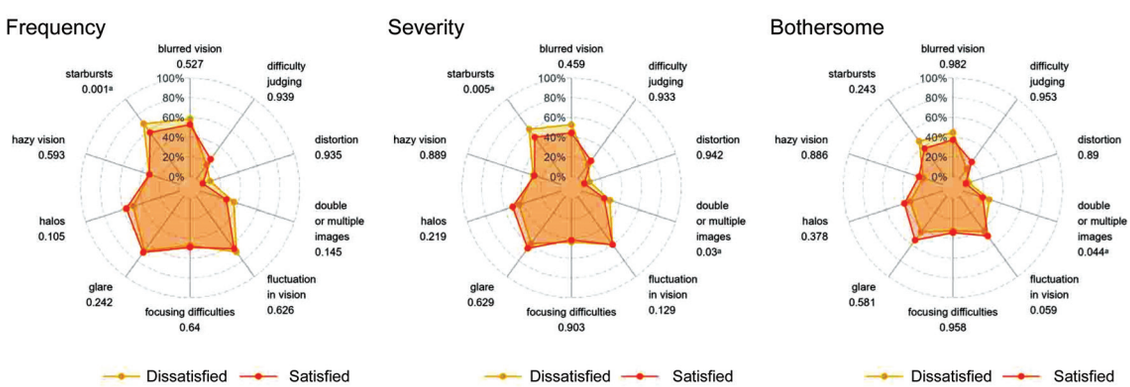

Figure 4 Spider plot representing the percentage of frequency, severity, and bothersome of each symptom in people with and without difficulty driving at night after SMILE and FS-LASIK SMILE: Small incision lenticule extraction; FS-LASIK: Femtosecond laser-assisted laser *in situ* keratomileusis. [a]*P*<0.05.

P=0.001; severity: *P*=0.003; bothersome: *P*=0.009; Figure 5A) of distortion and the frequency (*P*=0.016; Figure 5B) and severity (*P*=0.046; Figure 5B) of halos, but no statistical differences in other symptoms. There were no statistically significant differences in reported QoV between subgroups stratified by sex. The frequency (*P*=0.001; Figure 5D) and severity (*P*=0.005; Figure 5D) of starbursts were higher in the moderate and high myopia groups than in the low myopia group, and a similar trend was observed in severity (*P*=0.03; Figure 5C) and bothersome (*P*=0.044; Figure 5C) of double or multiple images, with no statistical differences in other symptoms in the subgroup analysis by preoperative degree of myopia.

DISCUSSION

The present study investigated factors influencing patient satisfaction after long-term corneal refractive surgery, including subjective quality of vision, behavioral habits, and accommodation. To our knowledge, this is the first study to evaluate postoperative satisfaction from multiple perspectives. We found that sex, severity of visual symptoms, and difficulty

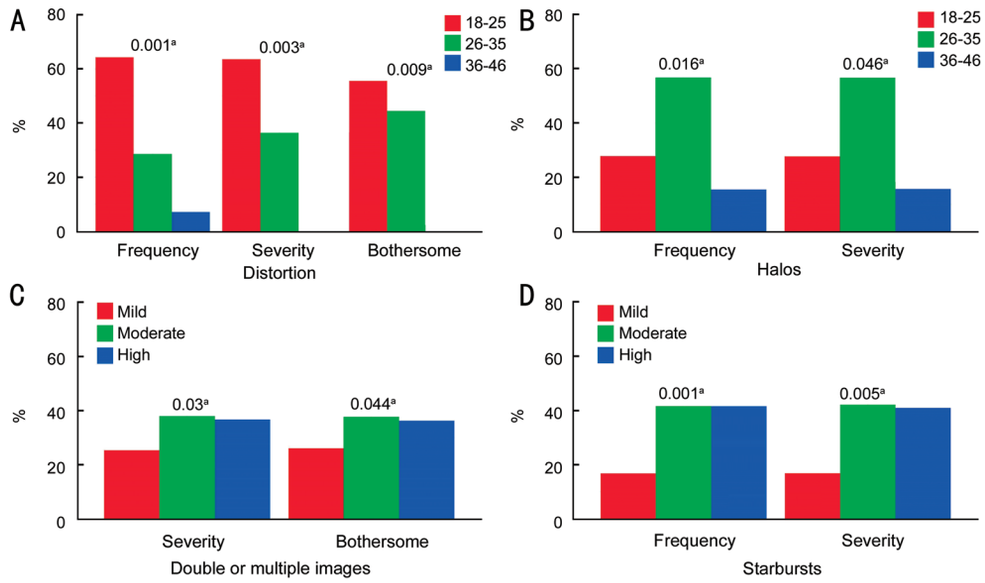

Figure 5 Cumulative histograms representing statistically different variables in Chi-squared tests analysis of frequency, severity and bothersome of each symptom in the populations were grouped by age (A, B) and pre-degree (C, D) after SMILE and FS-LASIK A, B: Subgroup analyses of visual symptoms by age illustrated statistically significant differences in three scales of distortion and the frequency and severity of halos, but no statistical differences in other symptoms. C, D: The frequency and severity of starbursts were higher in the moderate and high myopia groups than in the low myopia group, and a similar trend was observed in severity and bothersome of double or multiple images, with no statistical differences in other symptoms in the subgroup analysis by preoperative degree of myopia. SMILE: Small incision lenticule extraction; FS-LASIK: Femtosecond laser-assisted laser *in situ* keratomileusis. Pre: Preoperative; [a]*P*<0.05.

Table 3 Characteristics of people who have difficulty driving at night

Parameters	Difficulty driving at night, *n* (%)
Age	
18-25	23 (21.30)
26-35	33 (30.56)
36-46	52 (48.15)
Sex	
Female	61 (56.48)
Male	47 (43.52)
Pre-degree of myopia	
Mild myopia	17 (15.74)
Moderate myopia	35 (32.41)
High myopia	56 (51.85)
Frequency of visual symptoms (≥1)	96 (88.89)
Severity of visual symptoms (≥1)	104 (96.30)
Bothersome of visual symptoms (≥1)	95 (87.96)

≥1: Patients' score of visual symptoms.

driving at night were significantly associated with patient satisfaction, whereas the type of surgical procedure (SMILE or FS-LASIK) was not. The results also showed that the average age of the satisfied group was higher than that of the dissatisfied group. Significant differences were observed between the two groups in the frequency and severity of starbursts, as well as in the severity and bothersome of double or multiple images. These visual symptoms were more common and severe in patients with moderate and high myopia than in those with low myopia. Furthermore, the frequency, severity, and bothersome of distortion decreased with advancing age. However, no significant association was observed between behavioral habits, accommodation and patient satisfaction.

In the current study, the reported satisfaction rate 5y after LVC was 91.70%, which is consistent with previous studies ranging from 82% to 98%[19,24]. The postoperative satisfaction rate was higher in males (95.63%) than in females (89.20%). Moreover, in the dissatisfied group, the degree of myopia among females was higher than that among males. The average myopia degree for males was -4.93±2.46 D, while that for females was -5.18±2.63 D. Another study found that females tend to undergo refractive surgery at higher magnitudes of myopia compared with males[22]. The higher the degree of myopia, the higher the proportion of difficulty driving at night, and the greater impact of starbursts and double or multiple images on patients. In addition, male patients have less reactive emotional responses and higher tolerance for postoperative discomfort than female patients. Therefore, male patients tend to have higher postoperative satisfaction.

The satisfaction rate after LVC was 85.22% in the 18-25-year age group, 94.29% in the 26-35-year group, and 94.12% in the 36-46-year group. We found that younger age was associated with higher frequency, severity, and bothersomeness of distortion, which negatively affected postoperative patient satisfaction. In the myopic group, the overall blurring strength

initially decreased until the 30s, but then increased until the late 50s[25]. This pattern is consistent with the age-related trend in satisfaction observed in our study.

Our research showed that the severity of visual symptoms was negatively correlated with patient satisfaction. The dissatisfied group had higher scores across all three rating scales of visual symptoms-frequency, severity, and bothersomeness-with severity showing the most pronounced difference. Reinstein *et al*[4] reported that scores for symptom frequency were generally higher than those for severity, which in turn were higher than those for bothersomeness, suggesting that some patients were aware of the symptoms without being substantially affected in their daily lives. A similar pattern was observed in the satisfied group in our study. In contrast, the dissatisfied group exhibited the highest severity scores for visual symptoms. Night vision abnormalities were among the most common complications following corneal refractive surgery, and difficulty driving at night was a representative manifestation of this issue. The frequency and severity of starbursts, as well as the severity and bothersome of double or multiple images, significantly influenced patient satisfaction. These findings were consistent when patients were grouped according to their preoperative degree of myopia.

In the dissatisfied group, 50% of patients were under 25y of age, 35.29% were between 26 and 35 years old, and 14.71% were between 36 and 46 years old. High myopia accounted for 50.0% of this group, and females represented 79.41%. Satisfaction was age and UDVA-dependent, and anisometropic patients reported poorer satisfaction scores[26-27]. However, Negishi *et al*[26] showed that satisfaction is not entirely correlated with visual acuity; older patients may experience response shifts, and their subjective happiness scale score was higher than that of the younger group at baseline, initially increasing, but then continuously decreasing until there was no difference with the younger group. This finding is inconsistent with our results. The discrepancy may be attributed to differences in the refractive diopter ranges of the enrolled patients and the statistical grouping methods applied. In our study, patients with anisometropia were excluded, and age was categorized into more groups. These factors may contribute to the differences in statistical outcomes. Although the frequency of double or multiple images was not the highest among reported symptoms[4], their occurrence had a serious and bothersome impact on patients. Double or multiple images were more prevalent among patients with moderate or high myopia. This may partly explain why the dissatisfied group consisted predominantly of individuals with moderate and high myopia. The mean optical zone diameter was 6.51 mm in the dissatisfied group and 6.42 mm in the satisfied group, which may be associated with corneal aberrations and visual symptoms. Focusing difficulties, blurred vision, and fluctuation in vision were the most frequent symptoms, which all relate in some way to the refractive correction[4].

Patients with visual fluctuation, halos, and distortions were more likely to have difficulty driving at night. This may be attributed to the higher proportion of women, patients with high myopia, and older individuals in this group. After surgery, individuals with high myopia tended to report more visual symptoms compared to those with low or moderate myopia. SMILE for high myopia has been associated with higher-order aberrations and QoV symptoms, which may adversely affect night driving[4]. Older patients with decreased uncorrected near visual acuity struggle to adapt and accept the visual compromises inherent in presbyopia. This group eventually needs driving glasses and daily glasses, even after successful surgery[26,28]. Aged eyes may suffer from dry eye symptoms[29-30], and a common pathology of decreased visual function with increased aberration and increased scattering initially induced by tear film instability on the ocular surface[31-32].

Binocular visual function improved in most patients after surgery compared to preoperative levels, with the extent of improvement closely related to preoperative refraction and age[33].In the univariate analysis in this study, AMP showed statistical differences between groups but was strongly correlated with age. Significant difference was observed in age between the satisfied and dissatisfied groups, which would affect the results of univariate analysis in AMP. However, binary logistic regression analysis revealed no significant correlation between AMP and patient satisfaction. The International Myopia Institute White Paper states that the role of accommodation and binocular vision in the development and progression of myopia is not fully understood[34]. Although accommodative lag-induced blur may play a role in myopia development and progression, there is no clear evidence that accommodative lag is a risk factor for myopia progression. This implies that accommodation-induced hyperopic defocus may have a negligible contribution to myopia development in children, even with substantial near-work defocus[35-36]. Two hypotheses may explain these findings: accommodative lag may be a consequence rather than a cause of myopia, and the mechanisms underlying myopia onset and progression may differ. These insights may be relevant to interpreting our results. Further research is essential to clarify the accommodative and binocular mechanisms involved in myopia development and progression.

Our current study provided a new focus on patient satisfaction after SMILE or FS-LASIK for 5y. Although the refractive state of myopia can be corrected after refractive surgery, the underlying structural changes associated with myopia

remain irreversible. Some patients may complain about the postoperative visual symptoms. Concern about the factors influencing patient satisfaction is of paramount importance. Few studies investigated the associations between clinical parameters and subjective visual symptoms after corneal refractive surgery[4,13,37]. Many studies on visual quality after corneal refractive surgery are mainly conducted within two years after surgery; there are few large sample studies up to five years[4,11,13,37-39]. Long-term postoperative observation is essential to accurately reflect patients' real-world visual quality. However, several limitations should be considered. Data in our study were collected *via* questionnaires, which may be subject to recall bias. In addition, unmeasured time-related variables may cause residual confounding factors, and data collection cannot account for dynamic changes in visual acuity over time. Furthermore, this study lacked preoperative subjective visual quality, behavioral habits, and accommodation, as spectacle and contact lens wearers are known to have significant visual symptoms. Future studies should include relevant preoperative baseline parameters, incorporate dynamic visual acuity assessments[40], monitor patient-related parameters at multiple time points, and establish a comprehensive time–visual quality–satisfaction model to better identify factors influencing patient satisfaction and improve long-term postoperative outcomes.

In conclusion, patient satisfaction 5y after SMILE and FS-LASIK was 91.70%, which was high and stable. Difficulty driving at night, sex, and the severity of visual symptoms were important factors affecting patient satisfaction. Special attention should be paid to younger highly myopic patients, particularly those female patients with starbursts, double or multiple images and driving at night. It is essential to closely monitor postoperative visual symptoms and provide patients with detailed preoperative counseling and scientific guidance.

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