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Knowledge, attitudes, and practices toward femtosecond laser small incision lenticule extraction surgery and postoperative care among recipients

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Abstract

Background To investigate the knowledge, attitudes, and practices (KAP) of individuals who underwent small incision lenticule extraction (SMILE) surgery and explore the influencing factors.

Methods This cross-sectional study was conducted from June 21, 2023, to August 13, 2023, at Xiangyang Central Hospital. The participants were patients who had undergone SMILE surgery. The self-designed questionnaire had a Cronbach's α = 0.849. Multivariable analyses were performed to determine the factors influencing the KAP scores.

Results Finally, 485 valid questionnaires were analyzed. The median knowledge score was 14 (/17, 82.4%; IQR: 12–15). The median attitude score was 15 (/20, 75.0%; IQR: 14–16). The median practice score was 48 (/60, 80.0%; IQR: 42–54). The knowledge scores correlated to the attitude ($r = 0.323$, $P < 0.001$) and practice ($r = 0.202$, $P < 0.001$) scores, while the attitude scores correlated to the practice scores ($r = 0.065$, $P < 0.001$). College diploma (OR = 0.299, 95%CI: 0.110–0.812, $P = 0.018$), myopia for < 2 years (OR = 0.177, 95%CI: 0.060–0.526), and not receiving proper eye training (OR = 0.588, 95%CI: 0.402–0.862) were independently associated with knowledge. Being 19–30 years old (OR = 0.421, 95%CI: 0.235–0.756), being ≥ 31 years old (OR = 0.259, 95%CI: 0.111–0.601), myopia for 2–5 years (OR = 0.476, 95%CI: 0.232–0.978), myopia for 5–10 years (OR = 0.480, 95%CI: 0.263–0.875), and moderate myopia in the right eye (OR = 1.745, 95%CI: 1.024–2.974) were independently associated with attitude. Female gender (OR = 1.826, 95%CI: 1.196–2.787), being ≥ 31 years (OR = 2.587, 95%CI: 1.113–6.014), college diploma (OR = 3.436, 95%CI: 1.366–8.641), bachelor's degree (OR = 2.826, 95%CI: 1.214–6.581), and not having proper eye training (OR = 0.458, 95%CI: 0.310–0.677) were independently associated with practice.

Conclusions Patients who underwent SMILE had high KAP regarding SMILE. This study identified KAP items that would warrant education.

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Keywords Small incision lenticule extraction (SMILE), Postoperative care, Knowledge, Attitude, Practice

Background

Myopia is the most common refractive condition worldwide, with a prevalence of 18.5% in Asians, 13.2% in Hispanics, 6.6% in African Americans, and 4.4% in Caucasians [1]. Due to the COVID-19 pandemic and the increased use of screens, the incidence and prevalence of myopia have increased [2]. Spectacle correction is the most common form of management in patients with myopia [3, 4]. Still, spectacles modify the appearance, can be burdensome or impractical in some situations, and need frequent replacement. Laser vision correction is the surgical correction of refractive errors by remodeling the corneal surface using a laser [5, 6]. In many countries, it is the most common surgery for myopia. Laser surgery can be performed using a flap created using a femtosecond laser [7, 8]. Classical laser-assisted in situ keratomileusis (LASIK) was followed by excimer laser photoablation, but the development of femtosecond lasers for photoablation is the most recent development in myopia management [9–11]. Femtosecond lasers also enable the implementation of small incision lenticule extraction (SMILE) surgery [11–13]. The advantages of SMILE include a small incision with minimal risk, procedural safety, and no flap issues [11–13]. The disadvantages of SMILE include that it can only be performed for myopia, there is no evidence that it maintains corneal strength, it can induce dry eye, there is a risk of higher-order aberrations, it cannot be repeated if there is a residual error, and there is a recovery period [11–13]. Postoperative care involves using topical drugs to control inflammation, managing dry eye, avoiding rubbing the eye, avoiding bright light, and adapting to the new vision.

Therefore, postoperative care after SMILE involves self-management and is important to achieve the best outcomes. In addition, the patients should have proper expectations about the risk of residual error and complications after SMILE. The knowledge, attitude, and practice (KAP) methodology is a structured survey method used to assess the knowledge, attitudes, and practices of specific individuals toward a specific subject. KAP studies allow the identification of gaps, misconceptions, and misunderstandings that constitute barriers to adequate practice [14, 15]. There are currently no studies about the KAP toward SMILE (as of August 22, 2024). One study showed that patients lack understanding about lasers not altering the risk of complications of high myopia, including retinal holes and detachment [16]. A study in Nigeria revealed poor knowledge but negative attitudes toward laser surgery [17]. Similar results were observed by Ayanniyi et al. [18] and Robert et al. [19].

Therefore, the present study aimed to investigate the KAP of individuals who underwent SMILE surgery and explore the influencing factors. The results could allow for educational strategies and improve patient communication in the clinical setting.

Methods

Study design and participants

This cross-sectional study was conducted from June 21, 2023, to August 13, 2023, at Xiangyang Central Hospital. The participants were patients who had undergone SMILE surgery. The study was approved by the Medical Ethics Committee of Xiangyang Central Hospital. The participants provided informed consent before completing the questionnaire.

The inclusion criteria were (1) patients who underwent SMILE surgery and came back to the clinic for follow-up, (2) patients who were followed up at the study hospital, (3) patients with normal cognitive function, no communication barriers, and the ability to complete the questionnaire, and (4) the patients were informed about the study and voluntarily agreed to participate. The patients were routinely followed up at 1 day, 1 week, 1 month, and 3 months after the procedure. They could be enrolled at any follow-up visit. Patients were not enrolled beyond 3 months after the procedure. The exclusion criteria were (1) refused participation, (2) completed the questionnaire in <90 s, (3) incomplete or duplicate questionnaire, or (4) questionnaires with logical errors (e.g., impossible age or degree of myopia).

Questionnaires and data collection

The questionnaire was designed by the investigators based on SMILE system monographs and the literature. The questionnaire was administered to 39 SMILE patients randomly selected for a small-scale pilot test. The Cronbach's α was 0.849 in the pilot study, indicating high internal consistency.

The final questionnaire was in Chinese and consisted of four main sections: demographic characteristics (nine items), knowledge (17 items), attitudes (five items), and practices (12 items). Each subsection's scores were computed separately. For the knowledge section, the responses were scored 1 for "true" or 0 for "false" or "unsure." In contrast, the attitude section was scored using a five-point Likert scale, ranging from "totally agree" (5) to "totally disagree" (1). In the case of negatively phrased statements, their scores were reversed before calculating the total score. Similarly, the practice section was scored using a five-point Likert scale, spanning from "always" (5) to "never" (1).

An online questionnaire, accompanied by a QR code, was created using the WeChat-based Questionnaire Star applet for data collection via WeChat. The participants accessed the questionnaire by scanning the QR code and provided their responses.

Sample size calculation

The required sample size for the survey was determined using the Open Epi-calculator tool. The specific calculation formula employed was $= \frac{p\times(1-p)\times z^2}{e^2}$. This formula was referenced to ascertain the necessary sample size for the questionnaire survey [20, 21]. In this formula, n represents the required sample size, z corresponds to the Z statistic for the confidence level (where, for instance, the Z statistic for a 95% confidence level is 1.96, and for a 99% confidence level, it is 2.58), p signifies the estimated proportion of an outcome (typically set at 0.5), and e denotes the margin of sampling error (conventionally set at 5%). A smaller sampling error enhances the credibility of the conclusions.

$$n = \frac{0.5 \times (1 - 0.5) \times 1.96^2}{0.05^2} = 384.16$$

The results calculated using the formula yield a minimum sample size of 384 to ensure the necessary credibility of the research findings.

Statistical analysis

All data were analyzed using SPSS 22.0 (IBM, Armonk, NY, USA). The demographic characteristics of the study participants, along with scores in various dimensions, were analyzed descriptively. Firstly, the Kolmogorov-Smirnov normality test was conducted on the distribution of scores in each dimension. If the data conformed to a normal distribution, the data were presented as means ± standard deviations and analyzed using Student's t-test (two groups) or ANOVA (more than two groups); otherwise, they were presented as medians (interquartile ranges (IQRs)) and analyzed using the Mann-Whitney U-test (two groups) or the Kruskal-Wallis H-test. Pearson (normal distribution) or Spearman (non-normal distribution) were conducted on dimension scores. The KAP dimensions were dichotomized based on the mean or the median for regression analyses. Variables with $P<0.25$ in the univariable analyses were included in the multivariable regression analyses (using the KAP scores as the dependent variables). The results were presented as odds ratios (ORs) and 95% confidence intervals (CIs). ORs<1 indicated negative associations, while ORs>1 indicated positive associations. The results were considered not statistically significant when the 95%CI included 1. The *P*-values were reported to three decimal places, and two-sided *P*-values<0.05 were considered statistically significant.

Results

Demographic characteristics

A total of 485 valid questionnaires were ultimately collected. The results confirmed the good reliability and validity of the questionnaire, with a Cronbach's α of 0.851 and a Kaiser-Meyer-Olkin (KMO) of 0.890 for the whole study.

Table 1 presents the basic characteristics of the survey participants. The majority of the participants were male (58.6%), aged 19–30 (45.6%), with high/vocational school education (44.3%), living in urban areas (74.8%), were students (67.4%), had a myopia history of 5–10 years (46.4%), had moderate myopia (57.5%), and did not receive proper eye training (i.e., had not received education about the proper vision habits to prevent or slow down the progression of myopia) (51.8%). Among the participants, 21.9% had family members who underwent myopia surgery, 61.2% had friends who underwent the surgery, and 25.4% had no friends or family members who underwent myopia surgery (Table 2).

Knowledge

Knowledge scores are not normally distributed, with a median of 14 (IQR: 12–15). Knowledge scores differed significantly among patients with varying education levels ($P=0.001$), myopia duration ($P=0.045$), and myopia severity ($P=0.017$ and $P=0.004$). Higher scores were associated with advanced education, longer myopia history, and greater myopia severity. Patients who received appropriate eye training also had significantly higher knowledge scores ($P<0.001$). ($P<0.001$) (Table 1). The knowledge item with the highest score was K13 (97.3%; "One should restrict prolonged computer and smartphone usage post-surgery to prevent visual fatigue."), while the item with the lowest score was K4 (5.6%; "Individuals of any age can undergo the full femtosecond procedure.") (Table 3).

Attitudes

The attitude scores are not normally distributed, with a median of 15 (IQR: 14–16. Attitude scores differed significantly among patients of different ages ($P=0.003$), educational levels ($P=0.010$), occupations ($P=0.009$), and right-eye myopia severity ($P=0.020$), with younger patients demonstrating better attitudes. (Table 1). The attitude item with the highest score was A3 (90.5%; "In my opinion, the better one takes scientifically sound precautions and cares for their eyes in daily life, the better the surgical outcomes will be."), while the item with the lowest score was A1 (48.4%; "I believe that as long as a reputable hospital and skilled physician are chosen, there

Table 1 Characteristics of the participants

Variables	*n* (%)	Knowledge (K)		Attitude (A)		Practice (*P*)	
		Median (IQR)	*P*	Median (IQR)	*P*	Median (IQR)	*P*
Total	485	14 (12, 15)		15 (14, 16)		48 (42, 54)	
Gender			0.055		0.321		0.002
Male	284 (58.6)	14 (12,15)		15 (14,16)		47 (42,52)	
Female	201 (41.4)	14 (13,15)		15 (14,16)		50 (42,56)	
Age (years)			0.634		0.003		0.163
≤18 years	202 (41.6)	14 (12,15)		16 (14,17)		47 (42,53)	
19–30 years	221 (45.6)	14 (12,15)		15 (13,16)		48 (43,54)	
≥31 years	62 (12.8)	14 (13,15)		15 (13,16)		50 (44,56)	
Education			0.001		0.010		0.055
Junior high school or below	2 (0.4)	11 (9,13)		15 (15,15)		55 (50,60)	
High school/vocational school	215 (44.3)	14 (12,15)		15 (14,17)		46 (41,53)	
College diploma	89 (18.4)	13 (11,15)		14 (13,16)		49 (43,53)	
Bachelor's degree	149 (30.7)	14 (13,15)		15 (14,16)		49 (43,55)	
Postgraduate or higher	30 (6.2)	15 (13,15)		16 (14,17)		46 (38,52)	
Residence			0.907		0.545		0.205
Urban	363 (74.8)	14 (12,15)		15 (14,16)		48 (42,54)	
Rural	122 (25.2)	14 (12,15)		15 (14,16)		47 (41,53)	
Occupation			0.469		0.009		0.350
Student	327 (67.4)	14 (12,15)		15 (14,17)		48 (42,53)	
Office workers (government agencies, public institutions, enterprises, etc.)	73 (15.1)	14 (13,15)		15 (13,16)		49 (44,56)	
Manual laborer	4 (0.8)	12.5 (11.5,13.5)		13 (11.5,14.5)		54 (45,60)	
Other	81 (16.7)	14 (12,15)		15 (13,16)		48 (40,54)	
Duration of myopia			0.045		0.232		0.415
<2 years	25 (5.2)	13 (12,13)		15 (12,16)		44 (38,56)	
2–5 years	127 (26.2)	14 (12,15)		15 (14,17)		48 (42,53)	
5–10 years	225 (46.4)	14 (12,15)		15 (14,16)		48 (42,54)	
>10 years	108 (22.3)	14 (13,15)		15 (14,16)		49 (43.5,55)	
Degree of myopia before surgery (left eye)			0.017		0.194		0.771
Mild myopia	100 (20.6)	13 (12,15)		15 (13,16)		47.5 (41,54)	
Moderate myopia	279 (57.5)	14 (12,15)		15 (14,16)		48 (42,54)	
Severe myopia	106 (21.9)	14 (13,15)		15 (14,17)		48 (42,54)	
Degree of myopia before surgery (right eye)			0.004		0.020		0.147
Mild myopia	88 (18.1)	13 (12,15)		15 (12.5,16)		46 (40,53)	
Moderate myopia	284 (58.6)	14 (12,15)		15 (14,16)		48 (42,54)	
Severe myopia	113 (23.3)	14 (13,15)		15 (14,17)		47 (43,54)	
Received proper eye training			< 0.001		0.074		< 0.001
Yes	234 (48.2)	14 (13,15)		15 (14,17)		50 (44,56)	
No	251 (51.8)	14 (11,15)		15 (14,16)		46 (41,52)	

IQR: interquartile range

Table 2 Social experience with myopia surgery

Has your family or friends undergone myopia surgery?	*n* (%)
My family members have experienced it.	106 (21.9)
My friends have experienced it.	297 (61.2)
No one around me has experienced it.	123 (25.4)

will be no complications following the full femtosecond surgery.") (Table 4).

Practices

The distribution of practices scores is non-normal, with a median of 48 (IQR: 42–54. Female patients had significantly higher practice scores than males ($P=0.002$), and those who received eye-use training had significantly higher practice scores than those who did not ($P<0.001$) (Table 1). The practice item with the highest score was P12 (92.9%; "Following the surgery, I consistently adhere

Table 3 Knowledge dimension of the participants

	a. Correct	b. Incorrect	c. Uncertain
1. "Full femtosecond laser" and "femtosecond full laser" are identical, representing the same myopic surgical technique. (F)	54 (11.1)	271 (55.9)	160 (33)
2. The incision in a full femtosecond procedure resembles a small, smiling cherry-like opening; hence, it is also referred to as "SMILE (Smile) surgery." (T)	364 (75.1)	15 (3.1)	106 (21.9)
3. The full femtosecond procedure employs a precisely positioned laser scalpel to determine the thickness of corneal tissue to be cut, according to the patient's degree of myopia. (T)	419 (86.4)	9 (1.9)	57 (11.8)
4. Individuals of any age can undergo the full femtosecond procedure. (F)	27 (5.6)	370 (76.3)	88 (18.1)
5. Generally speaking, compared to a semi-femtosecond procedure, the full femtosecond procedure is better suited for specific occupational groups such as military personnel, law enforcement officers, athletes, and pilots. (T)	379 (78.1)	34 (7.0)	72 (14.8)
6. After a full femtosecond procedure, myopia is completely resolved after a recovery period. (F)	93 (19.2)	331 (68.2)	61 (12.6)
7. During the postoperative recovery period of a full femtosecond procedure, most patients may experience some degree of dry eye syndrome. (T)	383 (79.0)	32 (6.6)	70 (14.4)
8. One can engage in activities like jogging, yoga, boxing, and football if abnormalities occur during the second-day follow-up examination post-full femtosecond surgery. (F)	108 (22.3)	338 (69.7)	39 (8.0)
9. In the event of experiencing glare after a full femtosecond procedure, it is advisable to avoid night-time driving as much as possible. (T)	452 (93.2)	5 (1.0)	28 (5.8)
10. After a full femtosecond procedure, one should minimize rubbing the eyes. (T)	460 (94.8)	4 (0.8)	21 (4.3)
11. Avoiding or reducing cleaning around the operated eye and even facial regions is advisable to prevent eye infections. (F)	445 (91.8)	18 (3.7)	22 (4.5)
12. Avoiding eye cosmetics within the first two weeks after the surgery is recommended to reduce eye irritation and ensure thorough makeup removal. (T)	464 (95.7)	6 (1.2)	15 (3.1)
13. One should restrict prolonged computer and smartphone usage post-surgery to prevent visual fatigue. (T)	472 (97.3)	1 (0.2)	12 (2.5)
14. The dosage of steroid eye drops (such as dexamethasone) should not be increased or decreased without proper guidance to reduce the risk of related eye damage. (T)	447 (92.2)	4 (0.8)	34 (7.0)
15. In the case of postoperative dryness in the eyes, artificial tears can be used to enhance ocular lubrication. (T)	364 (75.1)	45 (9.3)	76 (15.7)
16. Consuming sweet, spicy, and irritating foods after the surgery can lead to corneal malnutrition, increased ocular congestion, and heightened foreign body sensation. (T)	448 (92.4)	9 (1.9)	28 (5.8)
17. Excessive postoperative stress can impair the eye's focusing ability, delaying postoperative recovery. (T)	417 (86.0)	11 (2.3)	57 (11.8)

Table 4 Attitude dimension of the participants

	a. Strongly agree	b. Agree	c. Neutral	d. Disagree	e. Strongly disagree
1. I believe that as long as a reputable hospital and skilled physician are chosen, there will be no complications following the full femtosecond surgery. (N)	55 (11.3)	68 (14.0)	127 (26.2)	201 (41.4)	34 (7.0)
2. I believe that full femtosecond surgery corrects vision permanently, and there will be no more myopia after the procedure. (N)	24 (4.9)	16 (3.3)	53 (10.9)	288 (59.4)	104 (21.4)
3. In my opinion, the better one takes scientifically sound precautions and cares for their eyes in daily life, the better the surgical outcomes will be. (P)	250 (51.5)	189 (39.0)	34 (7.0)	11 (2.3)	1 (0.2)
4. I believe that post-surgery, the eyes become more apprehensive of external environmental harm and more delicate than before the procedure. (P)	103 (21.2)	173 (35.7)	141 (29.1)	60 (12.4)	8 (1.6)
5. I feel that the results of the full femtosecond surgery have met my expectations for vision correction. (Open)	133 (27.4)	272 (56.1)	75 (15.5)	3 (0.6)	2 (0.4)

to the medication recommendations provided by the medical professionals and attend regular follow-up appointments at the hospital."), while the item with the lowest score was P1 (50.9%; "Before the surgery, I diligently follow information regarding the risks, postoperative complications, and aftercare for full femtosecond surgery on various online platforms.") (Table 5).

Correlations

As shown in Table 6, the knowledge scores correlated to the attitude ($r=0.323$, $P<0.001$) and practice ($r=0.202$, $P<0.001$) scores, while the attitude scores correlated to the practice scores ($r=0.065$, $P<0.001$).

Table 5 Practice dimension of the participants

	a. Always	b. Frequently	c. Sometimes	d. Occasionally	e. Never
1. Before the surgery, I diligently followed information regarding the risks, postoperative complications, and aftercare for full femtosecond surgery on various online platforms. (P)	130 (26.8)	117 (24.1)	111 (22.9)	94 (19.4)	33 (6.8)
2. Following the surgery, I conscientiously manage the time I spend on near and far vision activities, such as allocating 30–40 min for near vision tasks and 10–20 min for far vision activities. (P)	119 (24.5)	159 (32.8)	121 (24.9)	72 (14.8)	14 (2.9)
3. After the surgery, I made a deliberate effort to control my usage of electronic devices and aim to substitute them with daytime outdoor activities whenever possible. (P)	164 (33.8)	185 (38.1)	88 (18.1)	39 (8.0)	9 (1.9)
4. I maintain a clean indoor environment with adequate humidity to prevent dry and gritty eyes after the surgery. (P)	160 (33.0)	155 (32.0)	105 (21.6)	51 (10.5)	14 (2.9)
5. Post-surgery, I make every effort to maintain a well-lit and naturally lit home environment, avoiding exposure to strong light sources. (P)	211 (43.5)	180 (37.1)	69 (14.2)	20 (4.1)	5 (1.0)
6. In the first month following the surgery, I abstained from engaging in strenuous physical activities. (P)	200 (41.2)	156 (32.2)	62 (12.8)	49 (10.1)	18 (3.7)
7. I continuously manage my emotions to prevent undue anxiety regarding fluctuations in my vision after the surgery. (P)	204 (42.1)	171 (35.3)	67 (13.8)	32 (6.6)	11 (2.3)
8. After the surgery, I avoid splashing water into my eyes while washing my face or hair, and I take measures to prevent sweat from entering my eyes. (P)	292 (60.2)	129 (26.6)	41 (8.5)	17 (3.5)	6 (1.2)
9. Post-surgery, I refrain from touching or rubbing my eyes as a matter of course. (P)	241 (49.7)	142 (29.3)	59 (12.2)	34 (7.0)	9 (1.9)
10. I maintain a bland diet and avoid spicy, sweet, or greasy foods after the surgery. (P)	209 (43.1)	166 (34.2)	66 (13.6)	35 (7.2)	9 (1.9)
11. I purchase specialized products, such as eye-friendly lighting, to prevent the recurrence of my myopia. (P)	115 (23.7)	81 (16.7)	95 (19.6)	88 (18.1)	106 (21.9)
12. Following the surgery, I consistently adhere to the medication recommendations provided by the medical professionals and attend regular follow-up appointments at the hospital. (P)	347 (71.5)	104 (21.4)	22 (4.5)	9 (1.9)	3 (0.6)

Table 6 Correlation analysis

	Knowledge	Attitude	Practice
Knowledge	1.000	/	/
Attitude	0.323 ($P<0.001$)	1.000	/
Practice	0.202 ($P<0.001$)	0.065 ($P<0.001$)	1.000

Multivariable analyses

College diploma (OR=0.299, 95%CI: 0.110–0.812, $P=0.018$), myopia for <2 years (OR=0.177, 95%CI: 0.060–0.526, $P=0.002$), and not receiving proper eye training (OR=0.588, 95%CI: 0.402–0.862, $P=0.006$) were independently associated with the knowledge scores (Table 7). Being 19–30 years old (OR=0.421, 95%CI: 0.235–0.756, $P=0.004$), being ≥31 years old (OR=0.259, 95%CI: 0.111–0.601, $P=0.002$), myopia for 2–5 years (OR=0.476, 95%CI: 0.232–0.978, $P=0.043$), myopia for 5–10 years (OR=0.480, 95%CI: 0.263–0.875, $P=0.017$), and moderate myopia in the right eye (OR=1.745, 95%CI: 1.024–2.974, $P=0.041$) were independently associated with the attitude scores (Table 8). Female gender (OR=1.826, 95%CI: 1.196–2.787, $P=0.005$), being ≥31 years (OR=2.587, 95%CI: 1.113–6.014, $P=0.027$), college diploma (OR=3.436, 95%CI: 1.366–8.641, $P=0.009$), bachelor's degree (OR=2.826, 95%CI: 1.214–6.581, $P=0.016$), and not having proper eye training (OR=0.458, 95%CI: 0.310–0.677, $P<0.001$) were independently associated with the practice scores (Table 9).

Discussion

This cross-sectional study aimed to investigate the KAP of individuals who underwent SMILE surgery and explore the influencing factors. The results suggested that patients who underwent SMILE had high KAP regarding SMILE. Nevertheless, this study identified some KAP items that would warrant education.

Patients who undergo SMILE should be aware of the advantages and disadvantages of SMILE to have proper expectations after SMILE, and they also should be aware of adequate postoperative care since the outcomes also depend on the quality of the postoperative period [11–13]. The present study showed a relatively high KAP level toward SMILE in patients who underwent SMILE. No previous studies examined the KAP specifically toward SMILE, but previous studies showed poor knowledge and negative attitudes toward laser surgery, i.e., toward keratorefractive surgery [17], the alternatives to wearing eyeglasses [18], and refractive surgery in general [19], contrasting with the present study. It could be because the present study enrolled patients who underwent SMILE and, therefore, received education about it, while

Table 7 Univariable and multivariable regression analyses of knowledge

Cutoff value: ≥14/<14	No.	Univariable		Multivariable (input method)	
		OR (95%CI)	*P*	OR (95%CI)	*P*
Education					
High school/vocational school	122/217	0.467 (0.199,1.095)	0.080	0.455 (0.175,1.185)	0.107
College diploma	41/89	0.311 (0.125,0.772)	0.012	0.299 (0.110,0.812)	0.018
Bachelor's degree	94/149	0.621 (0.259,1.491)	0.287	0.520 (0.203,1.333)	0.173
Postgraduate or higher	22/30	ref.		ref.	
Duration of myopia					
<2 years	6/25	0.151 (0.056,0.413)	< 0.001	0.177 (0.060,0.526)	0.002
2–5 years	71/127	0.608 (0.356,1.037)	0.068	0.800 (0.411,1.557)	0.511
5–10 years	129/225	0.644 (0.398,1.043)	0.074	0.706 (0.410,1.216)	0.209
>10 years	73/108	ref.		ref.	
Degree of myopia before surgery (left eye)					
Mild myopia	48/100	ref.		ref.	
Moderate myopia	160/279	1.457 (0.921,2.304)	0.108	0.873 (0.464,1.645)	0.675
Severe myopia	71/106	2.198 (1.251,3.862)	0.006	1.263 (0.472,3.376)	0.642
Degree of myopia before surgery (right eye)					
Mild myopia	38/88	ref.		ref.	
Moderate myopia	167/284	1.878 (1.158,3.046)	0.011	1.618 (0.841,3.112)	0.149
Severe myopia	74/113	2.497 (1.408,4.428)	0.002	1.472 (0.549,3.945)	0.442
Received proper eye training					
Yes	151/234	ref.		ref.	
No	128/251	0.572 (0.397,0.824)	0.003	0.588 (0.402,0.862)	0.006

Table 8 Univariable and multivariable regression analyses of attitude

Cutoff value: ≥15 /<15	No.	Univariable		Multivariable (input method)	
		OR (95%CI)	*P*	OR (95%CI)	*P*
Age (years)					
≤18 years	144/202	ref.		ref.	
19–30 years	129/221	0.565 (0.376,0.847)	0.006	0.421 (0.235,0.756)	0.004
≥31 years	36/62	0.558 (0.309,1.005)	0.052	0.259 (0.111,0.601)	0.002
Duration of myopia					
<2 years	13/25	0.498 (0.206,1.204)	0.122	0.497 (0.182,1.357)	0.172
2–5 years	81/127	0.809 (0.470,1.394)	0.445	0.476 (0.232,0.978)	0.043
5–10 years	141/225	0.771 (0.474,1.256)	0.297	0.480 (0.263,0.875)	0.017
>10 years	74/108	ref.		ref.	
Degree of myopia before surgery (right eye)					
Mild myopia	46/88	ref.		ref.	
Moderate myopia	190/284	1.846 (1.135,3.000)	0.013	1.745 (1.024,2.974)	0.041
Severe myopia	73/113	1.666 (0.943,2.943)	0.079	1.375 (0.721,2.623)	0.333

the previous studies were performed in general populations [17–19]. Still, a study revealed poor knowledge of severe complications after laser surgery [16]. Of course, the quality of patient education plays an important role in KAP. Additional studies are necessary.

In the present study, participants with lower education, older, non-students, a shorter duration of myopia, and without proper eye training might benefit the most from knowledge and attitude interventions to improve their practice. Indeed, the present study showed that, albeit modest, the KAP dimensions were positively correlated to each other. The KAP theory stipulates that knowledge is the basis for adequate practice, while positive attitudes are the force driving practice [14, 15]. The present study showed that a higher socioeconomic status was generally associated with a better KAP toward SMILE. Indeed, a higher socioeconomic status is associated with higher health literacy [22], which could help translate into better KAP. In addition, a higher socioeconomic status involves more financial resources to pay for surgery, while patients with more modest resources might not consider the surgery at all. A longer myopia duration was also associated with higher knowledge and attitude scores, indicating that such patients had more time to gain knowledge and cultivate attitudes toward myopia through experience. Such patients could also be motivated by a higher wish

Table 9 Univariable and multivariable regression analyses of practice

Cutoff value: ≥48 /<48	No.	Univariable		Multivariable (input method)	
		OR (95%CI)	*P*	OR (95%CI)	*P*
Gender					
Male	130/284	ref.		ref.	
Female	124/201	1.908 (1.320,2.756)	0.001	1.826 (1.196,2.787)	0.005
Age (years)					
≤18 years	93/202	ref.		ref.	
19–30 years	123/221	1.471 (1.003,2.158)	0.048	1.602 (0.894,2.871)	0.113
≥31 years	38/62	1.856 (1.038,3.318)	0.037	2.587 (1.113,6.014)	0.027
Education					
High school/vocational school	100/217	1.282 (0.589,2.790)	0.531	2.453 (0.932,6.456)	0.069
College diploma	52/89	2.108 (0.907,4.900)	0.083	3.436 (1.366,8.641)	0.009
Bachelor's degree	90/149	2.288 (1.027,5.097)	0.043	2.826 (1.214,6.581)	0.016
Postgraduate or higher	12/30	ref.		ref.	
Received proper eye training					
Yes	144/234	ref.		ref.	
No	110/251	0.488 (0.339,0.701)	< 0.001	0.458 (0.310,0.677)	< 0.001

to be spectacle-free. Younger patients also had higher attitudes, probably because of a higher need for proper vision for studying and working and esthetic considerations, while older patients had better practice. Younger patients will also consider the long years of wearing spectacles, which could encourage the consideration of SMILE. Targeting patients with myopia at a higher risk of poor KAP toward SMILE could help offer them effective treatments.

Therefore, improving knowledge should translate into better attitudes and practices. The present study identified specific KAP items that would require education. Specifically, the distinction among different laser surgery techniques should be emphasized, as well as the optimal age for SMILE, the visual quality expectations after SMILE, and the postoperative care and precautions. Regarding attitudes, the expectations about safety and complications and the effects of the environment on the operated eyes should be improved. Regarding practice, the importance of proper preoperative preparation, postoperative care, and the use of proper lighting should be emphasized.

The study only included patients who were followed up at the study hospital, which could have introduced bias due to some patients living other areas and being followed up at local hospitals or patients who did not follow medical advice for follow-up may also be missing. Patients seen >3 months after the procedure were not included to improve sample homogeneity and to avoid the dilution of their experience in time. The patients with any communication barriers were excluded because communication was necessary to complete the questionnaire. Of course, quality control was applied to exclude possibly invalid questionnaires.

The present study had limitations. It was performed at a single center, limiting the generalizability of the results since all patients were from the same geographical area and were treated by the same medical team. The cross-sectional study prevented any causality analysis, and only associations could be analyzed. Furthermore, the results were obtained at a single point in time, but they could serve as a comparator to examine the impact of future educational interventions. The questionnaire was designed by the local investigators but could be biased by local practices and policies. All KAP studies are at risk of suffering from the social desirability bias, which entails that the participants could be tempted to answer what they know should be socially acceptable to do instead of what they are really doing.

Conclusions

In conclusion, patients who underwent SMILE at Xiangyang Central Hospital had high KAP regarding SMILE. Nevertheless, this study identified some KAP items that would warrant education. The results could be used to optimize educational strategies and improve patient communication in the clinical setting. Future studies should design and investigate the effect of interventions to improve the KAP toward SMILE.

Abbreviations

KAP Knowledge, attitudes, and practices
SMILE small incision lenticule extraction
LASIK Laser-assisted in situ keratomileusis
KMO Kaiser-Meyer-Olkin

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None.

Author contributions

Shaowei Zhang and Sha Cui carried out the studies, participated in collecting data, and drafted the manuscript. Lei Liu and Juan Zou performed the

statistical analysis and participated in its design. Qin Li, Pincheng Shen, and Pengqi Wang participated in the acquisition, analysis, or interpretation of data and drafted the manuscript. All authors read and approved the final manuscript.

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Data availability
All data generated or analyzed during this study are included in this published article.

Declarations

Ethics approval and consent to participate
This work has been carried out in accordance with the Declaration of Helsinki (2000) of the World Medical Association. The study was approved by the Medical Ethics Committee of Xiangyang Central Hospital (2023 – 130). The participants provided informed consent before completing the questionnaire.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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References

1. Kleinstein RN, Jones LA, Hullett S, Kwon S, Lee RJ, Friedman NE, et al. Refractive error and ethnicity in children. Arch Ophthalmol. 2003;121:1141–7.
2. Wong CW, Tsai A, Jonas JB, Ohno-Matsui K, Chen J, Ang M, et al. Digital screen time during the COVID-19 pandemic: risk for a further myopia boom? Am J Ophthalmol. 2021;223:333–7.
3. Goss DA. Effect of spectacle correction on the progression of myopia in children–a literature review. J Am Optom Assoc. 1994;65:117–28.
4. Schiefer U, Kraus C, Baumbach P, Ungewiss J, Michels R. Refractive errors. Dtsch Arztebl Int. 2016;113:693–702.
5. Vinciguerra R, Borgia A, Tredici C, Vinciguerra P. Excimer laser tissue interactions in the cornea. Exp Eye Res. 2021;206:108537.
6. Lu LW, Rocha-de-Lossada C, Rachwani-Anil R, Flikier S, Flikier D. The role of posterior corneal power in 21st century biometry: a review. J Fr Ophtalmol. 2021;44:1052–8.
7. Ambrosio R Jr., Wilson S. LASIK vs LASEK vs PRK: advantages and indications. Semin Ophthalmol. 2003;18:2–10.
8. Fogla R, Luthra G, Chhabra A, Gupta K, Dalal R, Khamar P. Preferred practice patterns for photorefractive keratectomy surgery. Indian J Ophthalmol. 2020;68:2847–55.
9. Bashir ZS, Ali MH, Anwar A, Ayub MH, Butt NH. Femto-lasik: the recent innovation in laser assisted refractive surgery. J Pak Med Assoc. 2017;67:609–15.
10. Lee JK, Chuck RS, Park CY. Femtosecond laser refractive surgery: small-incision lenticule extraction vs. femtosecond laser-assisted LASIK. Curr Opin Ophthalmol. 2015;26:260–4.
11. Wilson SE. Biology of keratorefractive surgery- PRK, PTK, LASIK, SMILE, inlays and other refractive procedures. Exp Eye Res. 2020;198:108136.
12. Wang Y, Ma J. Future developments in SMILE: higher degree of myopia and hyperopia. Asia Pac J Ophthalmol (Phila). 2019;8:412–6.
13. Doane JF, Cauble JE, Rickstrew JJ, Tuckfield JQ. Small incision lenticule extraction SMILE - the future of refractive surgery is Here. Mo Med. 2018;115:82–4.
14. Andrade C, Menon V, Ameen S, Kumar Praharaj S. Designing and conducting knowledge, attitude, and practice surveys in Psychiatry: practical Guidance. Indian J Psychol Med. 2020;42:478–81.
15. World Health Organization. Advocacy, communication and social mobilization for TB control: a guide to developing knowledge, attitude and practice surveys. http://whqlibdoc.who.int/publications/2008/9789241596176_eng.pdf. Accessed November 22, 20222008.
16. Lan C, Chen YH, Chen YJ, Lee JJ, Kuo HK, Wu PC. Outcomes and eye care knowledge in rhegmatogenous retinal detachment patients with a history of laser refractive surgery for myopia. Front Public Health. 2022;10:895024.
17. Abu OC, Olatunbosun K, Okonkwo O, Ashaye A, Abiem P: Knowledge, awareness and attitude towards keratorefractive surgery among myopes at Eye foundation hospital group, Nigeria. 14 August 2023, PREPRINT (Version 1) available at Research Square [https://doi.org/10.21203/rs.3.rs-3252499/v1]
18. Ayanniyi AA, Olatunji FO, Hassan RY, Adekoya BJ, Monsudi KF, Jamda AM. Awareness and attitude of spectacle wearers to alternatives to corrective eyeglasses. Asian J Ophthalmol. 2013;3:86–94.
19. Robert ET, Erwin EC, Rivera CRM. Demographic and clinical prole of patients who underwent refractive surgery screening. Philip J Ophthalmol. 2015;40:64–71.
20. Gebeyehu DT, Bekele D, Mulate B, Gugsa G, Tintagu T. Knowledge, attitude and practice of animal producers towards antimicrobial use and antimicrobial resistance in Oromia Zone, north eastern Ethiopia. PLoS ONE. 2021;16:e0251596.
21. Al-Qahtani AM. Clean hands, safe care: how knowledge, attitude, and practice impact hand hygiene among nurses in Najran, Saudi Arabia. Front Public Health. 2023;11:1158678.
22. Svendsen MT, Bak CK, Sorensen K, Pelikan J, Riddersholm SJ, Skals RK, et al. Associations of health literacy with socioeconomic position, health risk behavior, and health status: a large national population-based survey among Danish adults. BMC Public Health. 2020;20:565.

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