Reliability and Validity of the Persian Version of Quality of Life Impact of Refractive Correction Questionnaire

Ali Makateb[1,2], Amin Nabavi[1,2,3], Mahsa Naghash Tabrizi[4], Hesam Hashemian[2], Keyvan Shirzadi[1]

[1]Department of Ophthalomolgy, AJA University of Medical Sciences, Tehran, Iran, [2]Eye Research Center, Farabi Eye Hospital, Tehran University of Medical Sciences, Tehran, Iran, [3]Eye Research Center, Amir Almomenin Hospital, Guilan University of Medical Sciences, Rasht, Iran, [4]Department of Psychiatry, Tarbiat Modarres University, Tehran, Iran

Abstract

Purpose: To evaluate the psychometric properties of the Persian version of quality of life impact of refractive correction (QIRC) questionnaire and its utility in assessment of refractive error-related quality of life (QoL) following photorefractive keratectomy (PRK).

Methods: Patients with low-to-moderate myopia (-0.75 to -6.0) were enrolled in this study. Standard alcohol-assisted PRK was performed in all patients. The QIRC questionnaire was translated into a Persian version using the standard method. Patients completed QIRC questionnaire preoperatively and 3-month postoperatively. A group of patients completed the questionnaire twice preoperatively. Psychometric properties were evaluated by internal consistency (Cronbach's α), item-total correlation, and known group construct validity. Intraclass correlation coefficient (ICC) were used to examine the repeatability.

Results: One hundred forty-seven patients (60 males and 87 females) with a mean age of 26.3 ± 5.5 (range, 18–39) years were enrolled. Cronbach's α for total score was 0.923. Item-total correlation was above 0.3 for all items. ICC was 0.978 for total score. Preoperatively, predominantly contact lens wearers showed significantly better total QIRC score than predominantly spectacle wearers ($P = 0.017$), which showed good known group validity. Total QIRC score significantly increased from 41.31 ± 6.69 preoperatively to 50.47 ± 7.26 postoperatively ($P < 0.0001$). Improvement in total QIRC score was observed both in contact lens wearers and spectacle wearers.

Conclusion: The Persian version of QIRC questionnaire is a valid and reliable tool. Refractive error-related QoL assess by QIRC was significantly improved after PRK in an Iranian population.

Keywords: Photorefractive keratectomy, Quality of life, Refractive surgery, Validation

Address for correspondence: Amin Nabavi, Department of Ophthalmology, AJA University of Medical Sciences, Tehran, Iran.
E-mail: Nabavi16230@yahoo.com

Introduction

Refractive error is the leading cause of correctable visual impairment worldwide and in Iran.[1,2] Although spectacles and contact lenses are the most commonly used method to correct refractive errors and refractive surgery has become popular in the past two decades.[3] Objective clinical measures including visual acuity and manifest refraction are usually utilized to evaluate the results of refractive surgery. However, subjective reports of the outcome underlying the concept of vision-related quality of life (QoL) increasingly attracts attention.[4]

Several tools have been introduced and validated to assess the vision-related QoL in specific visual impairments. Some of these questionnaires such as the National Eye Institute Refractive Error Quality of Life Instrument (NEI-RQL)

Access this article online

Quick Response Code:

Website:
www.jcurrophthalmol.org

DOI:
10.4103/joco.joco_56_21

How to cite this article: Makateb A, Nabavi A, Naghash Tabrizi M, Hashemian H, Shirzadi K. Reliability and validity of the Persian version of quality of life impact of refractive correction questionnaire. J Curr Ophthalmol 2021;33:431-6.

and the Refractive Status Visual Profile (RSVP) are particularly designed to assess the refractive error-related QoL. However, these two above questionnaires are based on classical test theory.[5,6] The quality of life impact of refractive correction (QIRC) is a relatively new refractive error-related QoL questionnaire, which has been designed based on item response theory and Rasch modeling.[7] Rasch analysis-based questionnaires assigned a weighted score to each item choice, accounting for the effect of items on QoL.[8]

The original QIRC questionnaire has been shown to be highly valid in prepresbyopic patients with refractive correction or who have undergone refractive surgery.[9,10] The questionnaire has also been validated linguistically and psychometrically in some other languages.[11,12] In this study, we aimed to validate the Persian translation of QIRC and to assess its utility in the evaluation of refractive error-related QoL after photorefractive keratectomy (PRK).

METHODS

This study was conducted between June 2019 and October 2020 in Farabi Eye Hospital and a private clinic in Tehran. The ethical board committee approved the study protocol (IR. AJAUMS, REC.1397.106). Following the tenets of the Declaration of Helsinki, all patients provided informed consent. Myopic patients who aimed to undergo refractive surgery were enrolled in this study. Inclusion criteria were as follows: 18–39 years of age, corrected distance visual acuity (CDVA) of 20/25 or better, and spherical equivalent (SE) between −0.75 to −6 diopters (D). Patients who were not eligible for PRK (because of ocular and systemic conditions) or could not read Persian were excluded from the study.

The QIRC consists of 20 items evaluating the visual function, symptoms, convenience, economic and health concerns, and well-being. The questions have a five-category response scales ranging from "not at all" to "extremely" as well as a "do not know/not applicable" option. All responses are converted to a 0–100 scale, according to Rasch weighted scores which has been provided by developers (available at: http://pesudovs. com; accessed April, 2019). In converted values, the higher scores represent the higher functions in all items.

The QIRC questionnaire was translated into Persian using the standard method. Forward translation was performed by two independent translators. One separate translator performed backward translation. All translations were reviewed by translators and the study group (including ophthalmologists, a health psychologist, and a health education specialist) and a final version was created. This questionnaire was pilot tested by both self-administration and interviewer supervision in a group of 17 patients (not included in the study results) to assess the comprehension and cultural adaptation. The wording was changed in some items in the postoperative questionnaire, in order to place emphasis on refractive correction while the patients no longer wore spectacles or contact lenses. This alteration decreased the number of "not applicable" choices in postoperative questionnaires.

The questionnaire was administered to study participants by self-completion. Preoperative assessment was performed at the time of scheduling for surgery or day of surgery. A group of patients (*n* = 28) completed the questionnaire twice within 3-week preoperatively. All patients also completed the QIRC questionnaire at 3-month postoperatively.

Standard PRK was carried out using Technolas 217z100 excimer laser platform (Bausch and Lomb) under topical anesthesia. Alcohol-assisted epithelial debridement was performed in all procedures. Target refraction was set at emmetropia in all patients. Ophthalmic examination including slit-lamp examination, fundoscopy, and assessment of uncorrected distance visual acuity (UDVA), CDVA, and manifest refraction was performed at preoperative and postoperative visits. Demographic characteristics including age, gender, education, and marriage status were also collected.

Psychometric evaluation of the Persian version of QIRC was assessed by several methods. Response distribution was evaluated using the floor and the ceiling effects (percentages of participants with the lowest and highest scores). Cronbach's α and mean inter-item correlation were used to examine the internal consistency, which means that several items contributed to assess the same construct. Values of 0.7 or greater for Cronbach's α demonstrate good reliability.[13] Reliability was also determined by corrected item-total correlation. Correlation coefficients of 0.3 or higher are considered acceptable.[14] Known group construct validity was assessed by comparing the groups with expected difference (predominantly spectacle wearers and predominantly contact lens wearers in our study) based on previous investigations.[15] Predominantly, contact lens and spectacle wearer were defined as participants who wear contact lenses or spectacles in most of their waking hours. Some studies showed that contact lens wearers have better vision-related QoL than spectacle wearers.[10,11] These psychometric properties were assessed in preoperative evaluation. Intraclass correlation coefficient (ICC) were used to examine the repeatability in the study group that completed the questionnaire twice preoperatively. ICC of 0.7 or greater was considered acceptable.[16]

Wilcoxon rank test was used for the comparison of preoperative and postoperative data. Effect size was calculated by dividing the mean change by the standard deviation at baseline. Group comparison was performed using Mann–Whitney U-test (two groups) or Kruskal–Wallis test (more than two groups). Statistical analysis was performed using the SPSS software version 22.0 for Windows (SPSS Inc., Chicago, IL, USA). Significance was set at a 5% cut-off.

RESULTS

One hundred forty-seven patients (60 males and 87 females) with a mean age of 26.3 ± 5.5 (range, 18–39) years were

Table 1: Demographic characteristics of study participants

Characteristics	
Age (years)	
Mean±SD	26.3±5.5
Median (range)	25 (18–39)
Sex (%)	
Male	60 (40.8)
Female	87 (59.2)
Marriage status (%)	
Single	80 (54.4)
Married	56 (38.1)
Divorced	11 (7.5)
Education (years) (%)	
<12	12 (8.2)
12-16	104 (70.7)
>16	31 (21.1)
Refractive correction method (%)	
Predominantly spectacle	91 (61.9)
Predominantly contact lens	56 (38.1)
SE in worse eye (%)	
Mean±SD	−3.52±1.18
−0.75 - −3 (%)	55 (37.4)
<−3 (%)	92 (62.6)

SD: Standard deviation, SE: Spherical equivalent

enrolled in this study. Ninety-one patients (61.9%) were predominantly spectacles wearers and 56 patients (38.1%) were predominantly contact lenses wearers. Demographic and baseline clinical characteristics of study participants are illustrated in Table 1. Mean preoperative SE in the worse eye was −3.52 ± 1.18 D which decreased to −0.18 ± 0.38 at 3-months postoperatively. Ninety-three (63%) patients achieved UDVA of 20/20 or better, and 141 patients (95.9%) achieved UDVA of 20/25 or better in the worse eye.

Response rate of each item ranged from 92.2% to 100%. The floor effect ranged from 0% to 18.4%, and the ceiling effect ranged from 0% to 22.4% among different items. The floor effect was higher than 15% in one items, and the ceiling effect was higher than 15% in two items. Cronbach's α for total score was 0.923, which showed good internal consistency. Mean inter-item correlation was 0.384 for all items. Median item-total correlation was 0.580 (range, 0.311–0.836). ICC was 0.978 for total score, which showed excellent repeatability. ICC ranged from 0.759 to 0.973 among all items.

Preoperatively, predominantly contact lens wearers (42.42 ± 5.17) showed significantly better total QoL score than predominantly spectacle wearers (40.63 ± 7.42; *P* = 0.017), which showed good known group validity. Predominantly, contact lens wearers reported better QoL in item 1 ("Driving in glare conditions", *P* < 0.0001), item 2 ("Feeling eye tired or strained", *P* = 0.001), and item 18 ("Felt happy", *P* = 0.043). Patients with low myopia (SE ranged from −0.75 to −3.0) showed slightly better total QIRC score than moderate myopia (<−3.0),

but the difference was not significant (42.12 ± 6.86 vs. 40.84 ± 6.57; *P* = 0.337). In addition, total QIRC score was similar across gender (*P* = 0.260), education levels (*P* = 0.645), and marital status (*P* = 0.722).

Total QIRC score significantly increased from 41.31 ± 6.69 preoperatively to 50.47 ± 7.26 postoperatively (*P* < 0.0001). Preoperative and postoperative scores of each item are compared in Table 2. All except two items showed a significant increase in scores postoperatively: item 2 ("Feeling eyes tired or strained") significantly decreased at 3-month postoperative visit (50.40 ± 10.12 – 47.45 ± 10.12; *P* < 0.0001), and item 13 ("Concern about ultraviolet [UV] protection") did not significantly change postoperatively. Improvement in total QIRC score was observed both in predominantly contact lens wearers (42.42 ± 5.17 – 50 ± 5.57; *P* < 0.0001) and predominantly spectacle wearers (40.63 ± 7.42; 50.75 ± 8.14; *P* < 0.0001); however, predominantly spectacle wearers showed improvement in more items than predominantly contact lens wearers [Details are shown in Table 3].

DISCUSSION

QIRC is a specially designed questionnaire assessing the effect of refractive error on QoL. QIRC is considered a second generation of QoL questionnaires, which has been designed based on Rasch model.[17] Some shortcomings in classical test theory questionnaires (such as RSVP and NEI-RQL) have been overcome by Rasch analysis-based questionnaires. First, response choices of an item (eg., "Not at all" to "Extremely" in a 5-point Likert scale) do not represent the equal distances. For example, the distance between "Not at all" and "A little bit" is not equal to the distance between "Quite a lot" and "Extremely".[7] In addition, the same choice response in different items does not represent the equal QoL effect, for example, "Extremely" difficultly in "see on waking" item is not the same as "Extremely" difficulty in "Unaided vision for swimming".[5,7] Both of these assumptions have been proven by Rasch analysis, and proper weighted scores have been proposed. Rasch modeling has several other advantages including confirming a questionnaire to be unidirectional with relevant items.[8]

In our study, the completion rate was excellent for all items which showed good acceptability and appropriate wording of the Persian version of the questionnaire. Slight floor and ceiling effects were observed in some items; however, the other translations of the QIRC have also shown the same trend, especially in well-being domain.[12] This shows that the Persian version of QIRC could discriminate between wide ranges of response options. The Persian version of QIRC showed good psychometric properties. Reliability indices were acceptable. Cronbach's α was above 0.7 for total scores. Item-total correlation was above 0.3 for all items. The Persian version of QIRC also showed excellent repeatability with ICC of higher than 0.9.

Refractive error-related QoL improved in low-to-moderate myopic patients after PRK in our study. This is in line with

Table 2: Preoperative and postoperative scores of quality of life impact of refractive correction questionnaire

	Preoperative	Postoperative	P*	ES
1. How much difficulty do you have driving in glare conditions?				
Mean±SD	37.33±11.3	45.90±9.56	<0.0001	0.75
Median (IQR)	29.61 (29.61-45.06)	45.06 (45.06-45.06)		
2. During the past month, how often have you experienced your eyes feeling tired or strained?				
Mean±SD	50.40±10.12	47.45±10.12	<0.0001	−0.29
Median (IQR)	49.66 (49.66-49.66)	49.66 (34.21-49.66)		
3. How much trouble is not being able to use off-the-shelf (nonprescription) sunglasses?				
Mean±SD	38.42±13.07	43.35±12.87	0.005	0.37
Median (IQR)	41.26 (25.81-56.71)	41.26 (25.81-56.71)		
4. How much trouble is having to think about your spectacles or contact lenses before doing things; e.g., traveling, sport, going swimming?				
Mean±SD	35.11±11.07	48.82±12.53	<0.0001	1.24
Median (IQR)	30.47 (30.47-30.47)	45.92 (34.33-61.37)		
5. How much trouble is not being able to see when you wake up; e.g., to go to the bathroom, look after a baby, see alarm clock?				
Mean±SD	39.24±11.07	45.50±9.93	<0.0001	0.56
Median (IQR)	43.87 (28.42-43.87)	43.87 (43.87-59.32)		
6. How much trouble is not being able to see when you are on the beach or swimming in the sea or pool because you do these activities without spectacles or contact lenses?				
Mean±SD	38.44±10.14	52.34±10.82	<0.0001	1.37
Median (IQR)	33.03 (33.03-44.62)	48.48 (48.48-63.92)		
7. How much trouble are your spectacles or contact lenses when you wear them when using a gym/doing keep-fit classes/circuit training, etc.?				
Mean±SD	32.08±10.38	44.56±11.12	<0.0001	1.20
Median (IQR)	24.27 (24.27-39.72)	39.72 (39.72-55.17)		
8. How concerned are you about the initial and ongoing cost to buy your current spectacles and/or contact lenses?				
Mean±SD	43.47±10.54	56.03±11.82	<0.0001	1.19
Median (IQR)	33.71 (33.71-49.16)	64.61 (49.16-64.61)		
9. How concerned are you about the cost of unscheduled maintenance of your spectacles and/or contact lenses; e.g., breakage, loss, new eye problems?				
Mean±SD	36.23±11.60	49.47±13.48	<0.0001	1.14
Median (IQR)	29.73 (29.73-45.18)	60.62 (29.73-60.62)		
10. How concerned are you about having to increasingly rely on your spectacles or contact lenses since you started to wear them?				
Mean±SD	38.02±8.81	49.08±14.07	<0.0001	1.25
Median (IQR)	34.56 (34.56-34.56)	50.01 (34.56-65.46)		
11. How concerned are you about your vision being not as good as it could be?				
Mean±SD	38.32±9.74	51.24±12.47	<0.0001	1.32
Median (IQR)	34.24 (34.24-34.24)	49.69 (34.24-65.14)		
12. How concerned are you about medical complications from your spectacles and/or contact lenses?				
Mean±SD	34.12±10.27	49.45±10.83	<0.0001	1.49
Median (IQR)	28.59 (28.59-44.04)	59.49 (44.04-59.49)		
13. How concerned are you about eye protection from UV radiation?				
Mean±SD	46.61±13.03	46.06±10.75	0.819	0.04
Median (IQR)	35.72 (35.72-62.76)	51.17 (35.72-51.17)		
14. During the past month, how much of the time have you felt that you have looked your best?				
Mean±SD	47.55±16.84	52.16±20.65	0.006	0.27
Median (IQR)	45.52 (28.25-60.79)	60.79 (29.25-79.18)		
15. During the past month, how much of the time have you felt that you think others see you the way you would like them to (e.g., intelligent, sophisticated, successful, cool, etc.)?				

Contd...

Table 2: Contd...

	Preoperative	Postoperative	P*	ES
Mean±SD	49.53±15	61.04±18.76	<0.0001	0.82
Median (IQR)	48.99 (31.72-64.26)	64.26 (48.99-82.65)		
16. During the past month, how much of the time have you felt complimented/flattered?				
Mean±SD	52.17±15.49	61.27±19.18	<0.0001	0.59
Median (IQR)	54.55 (37.28-69.82)	54.55 (37.28-69.82)		
17. During the past month, how much of the time have you felt confident?				
Mean±SD	43.90±14.86	53.49±18.01	<0.0001	0.64
Median (IQR)	42.67 (25.40-57.94)	57.94 (42.67-57.94)		
18. During the past month, how much of the time have you felt happy?				
Mean±SD	43.57±13.52	52.83±14.84	<0.0001	0.75
Median (IQR)	39.61 (39.61-54.88)	54.88 (39.61-54.88)		
19. During the past month, how much of the time have you felt able to do the things you want to do?				
Mean±SD	33.48±13.48	42.57±13.71	<0.0001	0.67
Median (IQR)	31.66 (31.66-46.92)	46.92 (46.92-46.92)		
20. During the past month, how much of the time have you felt eager to try new things?				
Mean±SD	44.45±12.53	50.02±16.26	<0.0001	0.44
Median (IQR)	41.22 (41.22-56.48)	56.48 (41.22-56.48)		
Total				
Mean±SD	41.31±6.69	50.47±7.26	<0.0001	1.37
Median (IQR)	40.40 (36.23-45.17)	51.86 (45.77-55.52)		

*Wilcoxon rank test. ES: Effect size, SD: Standard deviation, IQR: Interquartile range, UV: Ultraviolet

Table 3: Preoperative and postoperative scores of quality of life impact of refractive correction questionnaire in spectacle and contact lens wearers

Items	Contact lens (n=56)			Spectacles (n=91)		
	Preoperative	Postoperative	P*	Preoperative	Postoperative	P*
1. Driving in glare conditions	44.12±13.35	46.74±10.42	0.074	33.99±8.42	45.44±9.08	<0.0001
2. Feeling tired or strained	53.80±9.99	50.49±10.38	0.014	48.30±9.68	45.59±9.17	0.005
3. Unable to use off-the-shelf sunglasses	40.61±14.23	42.25±13.05	0.667	37.05±12.19	44.16±12.80	<0.0001
4. Think before doing things	34.96±10.99	51.91±11.72	<0.0001	35.20±11.19	46.41±12.71	<0.0001
5. Trouble not see on waking	40.08±10.89	45.72±9.69	<0.0001	38.72±11.22	45.36±10.13	<0.0001
6. Unaided vision for swimming	38.57±10.09	51.97±11.59	<0.0001	38.36±10.22	52.56±10.39	<0.0001
7. Trouble with spectacles for gym	31.71±10.28	44.68±12.03	<0.0001	32.26±10.50	44.49±10.55	<0.0001
8. The initial and ongoing cost to buy	43.24±11.86	57.95±10.82	<0.0001	43.59±12.96	54.72±12.35	<0.0001
9. The cost of unscheduled maintenance	34.88±10.24	46.15±13.69	<0.0001	37±12.29	50.39±13.35	<0.0001
10. Concern about rely	38.35±9.54	50.30±14.23	<0.0001	37.80±7.21	48.25±13.99	<0.0001
11. Concern about your vision being not as good	38.82±9.79	52.84±12.51	<0.0001	38.01±9.75	50.23±12.42	<0.0001
12. Concern about medical complications	33.44±10.01	50.62±12.23	<0.0001	34.55±10.47	48.71±13.21	<0.0001
13. Concern about protection from UV	48.14±13.31	46.48±11.38	0.392	45.65±12.86	45.89±10.36	0.551
14. That you have looked your best	49.19±16.60	52.59±18.93	0.146	46.52±51.93	47.55±16.84	0.015
15. Think others see you the way want	51.06±14.49	56.95±16.08	0.051	48.60±15.31	63.56±19.90	<0.0001
16. Felt complimented	54.60±15.96	58.30±17.57	0.104	50.70±15.09	63.09±19.98	<0.0001
17. Felt confident	44.86±13.62	50.86±14.78	0.023	43.31±15.61	55.11±19.64	<0.0001
18. Felt happy	45.63±11.32	51.95±12.55	0.001	42.30±14.63	53.37±16.14	<0.0001
19. Felt able to do things you want to	35.18±12.09	41.53±12.99	0.066	32.45±14.22	43.21±14.17	<0.0001
20. Felt eager to try new things	44.98±11.66	44.59±14.08	0.873	44.11±13.08	53.35±16.69	<0.0001
Total	42.42±5.17	50±5.57	<0.0001	40.63±7.42	50.75±8.14	<0.0001

*Wilcoxon rank test. UV: Ultraviolet

previous investigations using QIRC evaluating the QoL after laser-assisted *in situ* keratomileusis (LASIK),[10,11,18,19] small incision lenticule extraction (SMILE),[19,20] and phakic intraocular lens implantation[9] in a wide range of myopia. To

evaluate the utility of the Persian version of QIRC, we enrolled patients with low-to-moderate myopia who had undergone PRK since this group represents the typical subpopulation of refractive surgery candidates in our country.[21] Considering all participants, only two items did not improve after refractive surgery: the item regarding symptoms "Eyes feeling tired or strained" significantly worsened, and the item "Concern about UV protection" did not change after refractive surgery. Some other studies using QIRC or other questionnaires have also shown that symptoms and glare may not improve or even worsen after keratorefractive surgery.[10,22] However, in contrast to ours, concerns about UV protection have improved after refractive surgery (LASIK or SMILE) in most previous studies.[10,11] This is due to different type of keratorefractive surgery (PRK) performed in our study. After PRK, we instruct patients to protect against the UV with sunglasses for at least 6 months while outdoors. Therefore, this item might not be appropriate to detect UV protection concerns soon after PRK.

Predominantly contact lens wearers showed better total QIRC scores than spectacle wearers at baseline, as expected.[10,11] Total QIRC score improved in both groups after refractive surgery. As shown in Table 3, predominantly spectacle wearers showed improvement in more items than predominantly contact lens wearers. Ability to use off-the-shelf sunglasses and 5 out of 7 items in the well-being domain only improved in spectacle wearers.

This study has some limitations. First, we did not perform Rasch analysis in the Persian translation of QIRC and assigned the previously reported Rasch measures to the item responses. Although performing Rasch analysis in cultural adaptation may have some advantages, developing various versions of a questionnaire in different populations and languages is confusing and limits the comparison between studies. Second, the study sample (low-to-moderate myopic patients) is only representative of refractive surgery candidates in our country and may not represent the total Persian-speaking population with refractive error.

In conclusion, the Persian translation of QIRC questionnaire showed acceptable validity and reliability in myopic patients who underwent refractive surgery. Total refractive error-related QoL assessed by Persian QIRC increased after PRK, and only symptoms about eye strain may be worsened early after surgery. Since UV protection is advised early after PRK, questioning about UV protection concerns may be confusing at this period.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

References

1. Naidoo KS, Leasher J, Bourne RR, Flaxman SR, Jonas JB, Keeffe J, *et al*. Global vision impairment and blindness due to uncorrected refractive error, 1990-2010. Optom Vis Sci 2016;93:227-34.
2. Fotouhi A, Hashemi H, Mohammad K, Jalali KH; Tehran Eye Study. The prevalence and causes of visual impairment in Tehran: The Tehran eye study. Br J Ophthalmol 2004;88:740-5.
3. Alio J. Refractive surgery today: Is there innovation or stagnation? Eye Vis (Lond) 2014;1:4.
4. Pesudovs K. Patient-centred measurement in ophthalmology – A paradigm shift. BMC Ophthalmol 2006;6:25.
5. Kandel H, Khadka J, Lundström M, Goggin M, Pesudovs K. Questionnaires for measuring refractive surgery outcomes. J Refract Surg 2017;33:416-24.
6. Kandel H, Khadka J, Goggin M, Pesudovs K. Patient-reported outcomes for assessment of quality of life in refractive error: A systematic review. Optom Vis Sci 2017;94:1102-19.
7. Pesudovs K, Garamendi E, Elliott DB. The Quality of life impact of refractive correction (QIRC) questionnaire: Development and validation. Optom Vis Sci 2004;81:769-77.
8. Petrillo J, Cano SJ, McLeod LD, Coon CD. Using classical test theory, item response theory, and Rasch measurement theory to evaluate patient-reported outcome measures: A comparison of worked examples. Value Health 2015;18:25-34.
9. Ieong A, Hau SC, Rubin GS, Allan BD. Quality of life in high myopia before and after implantable Collamer lens implantation. Ophthalmology 2010;117:2295-300.
10. Garamendi E, Pesudovs K, Elliott DB. Changes in quality of life after laser *in situ* keratomileusis for myopia. J Cataract Refract Surg 2005;31:1537-43.
11. Meidani A, Tzavara C, Dimitrakaki C, Pesudovs K, Tountas Y. Femtosecond laser-assisted LASIK improves quality of life. J Refract Surg 2012;28:319-26.
12. Kaphle D, Kandel H, Khadka J, Mashige KP, Msosa JM, Naidoo KS. Validation and use of quality of life impact of refractive correction questionnaire in spectacle wearers in Malawi: A clinic-based study. Malawi Med J 2020;32:54-63.
13. Aaronson N, Alonso J, Burnam A, Lohr KN, Patrick DL, Perrin E, *et al*. Assessing health status and quality-of-life instruments: Attributes and review criteria. Qual Life Res 2002;11:193-205.
14. DeVon HA, Block ME, Moyle-Wright P, Ernst DM, Hayden SJ, Lazzara DJ, *et al*. A psychometric toolbox for testing validity and reliability. J Nurs Scholarsh 2007;39:155-64.
15. Chassany O, Sagnier P, Marquis P, Fullerton S, Aaronson N. Patient-reported outcomes: The example of health-related quality of life – A European guidance document for the improved integration of health-related quality of life assessment in the drug regulatory process. Drug Inf J 2002;36:209-38.
16. McAlinden C, Khadka J, Pesudovs K. Statistical methods for conducting agreement (comparison of clinical tests) and precision (repeatability or reproducibility) studies in optometry and ophthalmology. Ophthalmic Physiol Opt 2011;31:330-8.
17. Grzybowski A, Kanclerz P, Muzyka-Woźniak M. Methods for evaluating quality of life and vision in patients undergoing lens refractive surgery. Graefes Arch Clin Exp Ophthalmol 2019;257:1091-9.
18. Ang M, Ho H, Fenwick E, Lamoureux E, Htoon HM, Koh J, *et al*. Vision-related quality of life and visual outcomes after small-incision lenticule extraction and laser *in situ* keratomileusis. J Cataract Refract Surg 2015;41:2136-44.
19. Han T, Xu Y, Han X, Shang J, Zeng L, Zhou X. Quality of Life Impact of Refractive Correction (QIRC) results three years after SMILE and FS-LASIK. Health Qual Life Outcomes 2020;18:107.
20. Han T, Zheng K, Chen Y, Gao Y, He L, Zhou X. Four-year observation of predictability and stability of small incision lenticule extraction. BMC Ophthalmol 2016;16:149.
21. Hashemi H, Khabazkhoob M, Pakzad R, Yekta A, Nojomi M, Nabovati P. The characteristics of excimer laser refractive surgery candidates. Eye Contact Lens 2018;44 Suppl 1:S158-62.
22. Schein OD, Vitale S, Cassard SD, Steinberg EP. Patient outcomes of refractive surgery. The refractive status and vision profile. J Cataract Refract Surg 2001;27:665-73.