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

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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

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)
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, accounting for the effect of items on QoL.8

The original QIRC questionnaire has been shown to be highly valid in presbyopic 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 scale 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://pseudovs.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
enrolled in this study. Ninety-one patients (61.9%) were predominantly spectacle wearers and 56 patients (38.1%) were predominantly contact lens wearers. Demographic and baseline clinical characteristics of study participants are illustrated in Table 1. Mean preoperative SE in the worse eye was $-3.52 \pm 1.18$ D which decreased to $-0.18 \pm 0.38$ 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 22.4% among different items. The floor effect was higher than 15% in two items. Cronbach’s $\alpha$ 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 ($42.42 \pm 5.17$) showed significantly better total QoL score than predominantly spectacle wearers ($40.63 \pm 7.42$; $P = 0.017$), 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 ($42.12 \pm 6.86$ vs. $40.84 \pm 6.57$; $P = 0.337$). 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 $41.31 \pm 6.69$ preoperatively to $50.47 \pm 7.26$ 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 ($50.40 \pm 10.12 – 47.45 \pm 10.12$; $P < 0.0001$), 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 ($42.42 \pm 5.17 – 50 \pm 5.57$; $P < 0.0001$) and predominantly spectacle wearers ($40.63 \pm 7.42; 50.75 \pm 8.14$; $P < 0.0001$); 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. 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”. In addition, the same choice response in different items does not represent the equal QoL effect, for example, “Extremely” difficulty in “see on waking” item is not the same as “Extremely” difficulty in “Unaided vision for swimming”. 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.

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. 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 $\alpha$ 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

| Question                                                                 | Preoperative | Postoperative | P*   | ES   |
|---------------------------------------------------------------------------|--------------|---------------|------|------|
| 1. How much difficulty do you have driving in glare conditions?         | 37.33±11.3   | 45.90±9.56    | <0.0001 | 0.75 |
| Mean±SD                                                                  | 29.61 (29.61-45.06) | 45.06 (45.06-45.06) |      |      |
| Median (IQR)                                                             |              |               |      |      |
| 2. During the past month, how often have you experienced your eyes feeling tired or strained? | 50.40±10.12  | 47.45±10.12   | <0.0001 | -0.29|
| Mean±SD                                                                  | 49.66 (49.66-49.66) | 49.66 (49.66-49.66) |      |      |
| Median (IQR)                                                             |              |               |      |      |
| 3. How much trouble is not being able to use off-the-shelf (nonprescription) sunglasses? | 38.42±13.07  | 43.35±12.87   | 0.005 | 0.37 |
| Mean±SD                                                                  | 41.26 (25.81-56.71) | 41.26 (25.81-56.71) |      |      |
| Median (IQR)                                                             |              |               |      |      |
| 4. How much trouble is having to think about your spectacles or contact lenses before doing things; e.g., traveling, sport, going swimming? | 35.11±11.07  | 48.82±12.53   | <0.0001 | 1.24 |
| Mean±SD                                                                  | 30.47 (30.47-30.47) | 45.92 (34.33-61.37) |      |      |
| Median (IQR)                                                             |              |               |      |      |
| 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? | 39.24±11.07  | 45.50±9.93    | <0.0001 | 0.56 |
| Mean±SD                                                                  | 43.87 (28.42-43.87) | 43.87 (43.87-59.32) |      |      |
| Median (IQR)                                                             |              |               |      |      |
| 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? | 38.44±10.14  | 52.34±10.82   | <0.0001 | 1.37 |
| Mean±SD                                                                  | 33.03 (33.03-44.62) | 48.48 (48.48-63.92) |      |      |
| Median (IQR)                                                             |              |               |      |      |
| 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.? | 32.08±10.38  | 44.56±11.12   | <0.0001 | 1.20 |
| Mean±SD                                                                  | 24.27 (24.27-39.72) | 39.72 (39.72-55.17) |      |      |
| Median (IQR)                                                             |              |               |      |      |
| 8. How concerned are you about the initial and ongoing cost to buy your current spectacles and/or contact lenses? | 43.47±10.54  | 56.03±11.82   | <0.0001 | 1.19 |
| Mean±SD                                                                  | 33.71 (33.71-49.16) | 64.61 (49.16-64.61) |      |      |
| Median (IQR)                                                             |              |               |      |      |
| 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? | 36.23±11.60  | 49.47±13.48   | <0.0001 | 1.14 |
| Mean±SD                                                                  | 29.73 (29.73-45.18) | 60.62 (29.73-60.62) |      |      |
| Median (IQR)                                                             |              |               |      |      |
| 10. How concerned are you about having to increasingly rely on your spectacles or contact lenses since you started to wear them? | 38.02±8.81   | 49.08±14.07   | <0.0001 | 1.25 |
| Mean±SD                                                                  | 34.56 (34.56-34.56) | 50.01 (34.56-65.46) |      |      |
| Median (IQR)                                                             |              |               |      |      |
| 11. How concerned are you about your vision being not as good as it could be? | 38.32±9.74   | 51.24±12.47   | <0.0001 | 1.32 |
| Mean±SD                                                                  | 34.24 (34.24-34.24) | 49.69 (34.24-65.14) |      |      |
| Median (IQR)                                                             |              |               |      |      |
| 12. How concerned are you about medical complications from your spectacles and/or contact lenses? | 34.12±10.27  | 49.45±10.83   | <0.0001 | 1.49 |
| Mean±SD                                                                  | 28.59 (28.59-44.04) | 59.49 (44.04-59.49) |      |      |
| Median (IQR)                                                             |              |               |      |      |
| 13. How concerned are you about eye protection from UV radiation?        | 46.61±13.03  | 46.06±10.75   | 0.819 | 0.04 |
| Mean±SD                                                                  | 35.72 (35.72-62.76) | 51.17 (35.72-51.17) |      |      |
| Median (IQR)                                                             |              |               |      |      |
| 14. During the past month, how much of the time have you felt that you have looked your best? | 47.55±16.84  | 52.16±20.65   | 0.006 | 0.27 |
| Mean±SD                                                                  | 45.52 (28.25-60.79) | 60.79 (29.25-79.18) |      |      |
| Median (IQR)                                                             |              |               |      |      |
| 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.?) |          |               |      |      |
previous investigations using QIRC evaluating the QoL after laser-assisted in situ keratomileusis (LASIK),\textsuperscript{16,18,19} small incision lenticule extraction (SMILE),\textsuperscript{19,20} and phakic intraocular lens implantation\textsuperscript{9} in a wide range of myopia. To

Table 2: Contd...

| Items | Preoperative | Postoperative | P* | ES |
|-------|--------------|---------------|----|----|
| 16. During the past month, how much of the time have you felt complimented/ flattered? | Mean±SD | Median (IQR) | Mean±SD | Median (IQR) |
|       | 52.17±15.49 | 54.55 (37.28-69.82) | 61.27±19.18 | 54.55 (37.28-69.82) |
| 17. During the past month, how much of the time have you felt confident? | Mean±SD | Median (IQR) | Mean±SD | Median (IQR) |
|       | 43.90±14.86 | 42.67 (25.40-57.94) | 53.49±18.01 | 57.94 (42.67-57.94) |
| 18. During the past month, how much of the time have you felt happy? | Mean±SD | Median (IQR) | Mean±SD | Median (IQR) |
|       | 43.57±13.52 | 39.61 (37.28-69.82) | 52.83±14.84 | 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 | Median (IQR) | Mean±SD | Median (IQR) |
|       | 33.48±13.48 | 42.57±13.71 | 58.83±14.84 | 54.88 (39.61-54.88) |

*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) Preoperative | Contact lens (n=56) Postoperative | P* | Spectacles (n=91) Preoperative | Spectacles (n=91) 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±12.9 | 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 | <0.0001 | 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±5.57 | <0.0001 | 40.63±7.42 | 50.75±8.14 | <0.0001 |

*Wilcoxon rank test. UV: Ultraviolet
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. 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. However, in contrast to ours, concerns about UV protection have improved after refractive surgery (LASIK or SMILE) in most previous studies. 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. 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.

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Conflicts of interest
There are no conflicts of interest.

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