

# A quality of life assessment of military recruits after refractive surgery

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## Abstract

• **AIM:** To evaluate the quality of life of recruits after refractive surgery.

• **METHODS:** Population-based, cross-sectional study. Using the Quality of Life Impact of Refractive Correction (QIRC) questionnaire, the quality of life in 615 recruits underwent refractive surgery was evaluated. The overall score and each question score of QIRC were compared between subgroups of different strength of preoperative refractive error, postoperative interval, type of surgical procedure and postoperative recovery.

• **RESULTS:** The mean overall QIRC score of recruits underwent refractive surgery was  $49.15 \pm 7.89$ . Significant difference was found for strength of preoperative refractive error ( $F=4.16$ ,  $P<0.05$ ), with the low myopia group ( $50.67 \pm 7.59$ ) had significantly better scores than those with high myopia ( $47.57 \pm 7.52$ ,  $F=4.16$ ,  $P<0.05$ ). Recruits after a postoperative interval no more than 6mo ( $49.18 \pm 7.86$ ) scored equally to those of more than 6mo ( $49.18 \pm 8.03$ ). Recruits underwent surface ablation surgery scored lowest ( $46.68 \pm 6.09$ ), but showed no significant difference when compared with all underwent refractive surgery ( $t=1.99$ ,  $P>0.05$ ). Scores of recruits underwent mechanical microkeratome laser in situ keratomileusis (MK-LASIK), Sub-Bowman's keratomileusis (SBK), femtosecond laser-assisted laser in situ keratomileusis (FS-LASIK), femtosecond lenticule extraction (ReLEx flex) or small-incision lenticule extraction (ReLEx SMILE) procedure showed no significant difference too. Recruits had adverse complaints postoperatively ( $45.85 \pm 6.66$ ) scored lower when compared with all underwent refractive surgery ( $t=5.28$ ,  $P<0.01$ ).

• **CONCLUSION:** The quality of life of recruits after refractive surgery was good except those with postoperative

**complications. Preoperative low myopia recruits had better quality of life than medium and high myopia ones.**

• **KEYWORDS:** refractive surgery; quality of life; military member

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## INTRODUCTION

Although postoperative visual acuity (VA) was often used to evaluate the outcome of refractive surgery (RS), the most important aim of the patients was not just uncorrected visual acuity (UCVA), but the improvement of visual function and the quality of their life. In some cases, patient complained a lot though his or her postoperative VA was above 20/20, because some discomforts did really disturb his or her daily life. Doctors can ascribe these discomforts to repair of the tissue, postoperative high order aberration (HOA) or some other explanations, but patients only care about their own feelings. From the point of view of patient-centered evaluation, postoperative vision-related quality of life (QoL) evaluation was more critical than clinical physical examinations.

There are three commonly used questionnaires to assess QoL after RS: Quality of Life Impact of Refractive Correction (QIRC), Refractive Status Vision Profile (RSVP) and National Eye Institute Refractive Error Quality of Life Instrument (NEI-RQL)<sup>[1-3]</sup>. QIRC, a questionnaire consists of only 20 questions, use Rasch analysis and can provide an appropriate weighting factor for each question. So it was an effective measure for QoL impact of refractive correction<sup>[4]</sup>.

## SUBJECTS AND METHODS

**Ethical Approval** The study conformed to the tenets of the Declaration of Helsinki gained approval from the Hospital Ethical Committee. Written informed consent was obtained from the patients.

The QoL of 665 male military recruits underwent RS were evaluated in Oct. of 2014, two months after they joined the army. First, health education for RS was given. Then the aim of the investigation was fully explained that there was no good or bad answer in all responses. QIRC questionnaire was

**Table 1 Comparison of QIRC scores of recruits of different strength of preoperative refractive error (spherical equivalent) before surgery**

Strength of preoperative refractive error	No. of cases	Percentage	QoL score
Low myopia (<-3.00 D)	148	24.06	50.67±7.59
Moderate myopia (≥-3.00 D but <-6.00 D)	410	66.67	48.86±8.01
High myopia (≥-6.00 D)	57	9.27	47.57±7.52

QIRC: Quality of Life Impact of Refractive Correction; QoL: Quality of life.

translated from English to Chinese for the QoL assessment. It consists of 20 questions and should take 3-5min to fill it out. Finally, the questionnaires were filled out and all the questions about the questionnaire were timely answered.

The raw data of responses are converted to Rasch weighted scores by a free Excel chart for scoring conversion which Pesudovs *et al*<sup>[1]</sup> provided. Software STATA 10.0 (TX, USA) for Windows was used for statistical analysis. The overall scores and score of each question were compared between subgroups of different strength of preoperative refractive error, postoperative interval, type of surgical procedure and postoperative recovery. The statistical results were considered significant if  $P < 0.05$ .

## RESULTS

All questionnaires were reviewed and 40 questionnaires were discarded as they appeared to provide unreliable responses, or more than 10 items were responded with “don’t know/ not applicable”, or missed responses were more than 6 items. Finally, 615 (92.48%) questionnaires were used for statistical analysis. Of 615 recruits (1224 eyes, only one eye underwent RS in 6 myopic recruits) underwent RS, the mean age was 19.15±1.63 (16 to 24)y. The mean overall QIRC score of recruits underwent RS was 49.15±7.89.

Of 615 recruits underwent RS, the mean strength of preoperative refractive error (spherical equivalent) before surgery was 3.82±1.48 D, with 148 (24.07%) being low myopia (<-3.00 D), 410 (66.67%) being moderate myopia (≥-3.00 D but <-6.00 D) and 57 (9.27%) being high myopia (≥-6.00 D). The mean overall QIRC score of low myopia group, moderate myopia group and high myopia group was 50.67±7.59, 48.86±8.01 and 47.57±7.52 respectively (Table 1). Using variance analysis, there was significant difference of three groups ( $F=4.16$ ,  $P < 0.05$ ), with the low myopia group having a better QIRC score than the high myopia group ( $F=3.10$ ,  $P < 0.05$ ), while the moderate myopia group was not significantly different from both the low myopia group ( $F=1.80$ ,  $P > 0.05$ ) and the high myopia group ( $F=1.29$ ,  $P > 0.05$ ).

Postoperative interval of 404 (65.69%) recruits underwent RS was no more than 6mo and the mean overall QIRC score was 49.18±7.86, and postoperative interval of 211 (34.31%) recruits was more than 6mo and the mean overall QIRC score was 49.18±8.03 (Table 2). Using non-paired Student’s *t*-test,

**Table 2 Comparison of QIRC scores of recruits of different postoperative interval**

Postoperative interval	No. of cases	Percentage	QoL score
No more than 6mo	404	65.69	49.18±7.86
More than 6mo	211	34.31	49.18±8.03

QIRC: Quality of Life Impact of Refractive Correction; QoL: Quality of life.

**Table 3 Comparison of QIRC scores of recruits underwent different surgical procedure**

Surgical procedure	No. of cases	Percentage	QoL score
Surface ablation surgery	24	3.90	46.68±6.09
Lamellar ablation surgery			
MK-LASIK	379	61.63	49.15±7.73
FS-LASIK	139	22.60	49.57±8.24
ReLEx FLEx or SMILE	54	8.78	48.32±8.36
SBK	19	3.09	48.32±8.36

QIRC: Quality of Life Impact of Refractive Correction; QoL: Quality of life; MK-LASIK: Mechanical microkeratome laser *in situ* keratomileusis; FS-LASIK: Femtosecond laser-assisted laser *in situ* keratomileusis; ReLEx flex: Femtosecond lenticule extraction; SMILE: Small-incision lenticule extraction; SBK: Sub-Bowman’s keratomileusis.

there was no significant difference between two groups ( $t=0.00$ ,  $P > 0.05$ ). All 615 recruits underwent laser corneal RS and no lenticular RS cases. Twenty-four (3.90%) recruits underwent surface ablation surgery and the mean overall QIRC score was 46.68±6.09. Of 591 (96.10%) recruits underwent lamellar ablation surgery, 379 (61.63%) recruits underwent mechanical microkeratome laser *in situ* keratomileusis (MK-LASIK), 19 (3.09%) recruits underwent Sub-Bowman’s keratomileusis (SBK), 139 (22.60%) recruits underwent femtosecond laser-assisted laser *in situ* keratomileusis (FS-LASIK), 54 (8.78%) recruits underwent femtosecond lenticule extraction (ReLEx flex) or small-incision lenticule extraction (ReLEx SMILE), and the mean overall QIRC score was 49.15±7.73, 48.32±8.36, 49.57±8.24, 48.32±8.36 respectively (Table 3). Using Student’s *t*-test, when compared with the mean overall QIRC score of all recruits underwent RS, there was no significant difference of each type of RS: surface surgery ( $t=1.99$ ,  $P > 0.05$ ), MK-LASIK ( $t=0.00$ ,  $P > 0.05$ ), SBK ( $t=0.43$ ,  $P > 0.05$ ), FS-LASIK ( $t=0.60$ ,  $P > 0.05$ ), ReLEx flex or smile ( $t=0.73$ ,  $P > 0.05$ ).

**Table 4 Comparison of QIRC scores of recruits with adverse complaints and all recruits underwent RS**

Item	QIRC scores (mean±SD)		<i>t</i>	<i>P</i>
	All recruits underwent RS ( <i>n</i> =615)	Recruits with adverse complaints ( <i>n</i> =158)		
Total QIRC score in each group	49.15±7.89	45.85±6.66	6.23	0.000
1. Driving in glare conditions	52.44±10.81	47.06±11.25	4.41	0.000
2. Eyes feeling tired or strained	51.15±10.53	44.35±10.62	8.05	0.000
3. Unable to use non-Rx sunglasses	47.68±10.70	41.10±11.54	7.08	0.000
4. Having to think about...before doing	59.05±6.23	56.04±8.761	4.01	0.000
5. Not being able see on waking	56.41±7.19	53.49±9.55	3.83	0.000
6. Unaided vision for swimming	59.43±9.51	54.81±13.04	3.42	0.001
7. Trouble with spectacles...for gym	39.84±13.75	38.18±14.14	1.16	0.248
8. The initial and ongoing cost to buy	59.52±9.55	58.87±9.90	0.66	0.509
9. The cost of unscheduled maintenance	49.08±12.37	43.97±13.90	3.91	0.000
10. Increasingly reliant upon	52.41±13.10	46.15±13.14	5.26	0.000
11. Vision not as being as good as could	48.81±12.17	41.41±9.21	9.91	0.000
12. Medical complications from	44.82±11.74	38.89±10.59	6.97	0.000
13. UV protection	51.51±11.78	46.02±10.67	6.28	0.000
14. That you have looked your best	48.57±18.90	47.88±18.94	0.46	0.649
15. Think others see you the way want	46.72±18.25	45.81±17.83	0.62	0.538
16. Complimented/flattered	50.35±17.77	51.62±17.34	-0.92	0.360
17. Confident	46.07±18.47	44.29±19.88	1.12	0.265
18. Happy	45.30±18.25	41.91±18.39	2.32	0.022
19. Able to do things you want to	33.92±18.70	31.22±18.69	1.80	0.073
20. Eager to try new things	46.50±19.22	43.86±18.17	1.81	0.072

QIRC: Quality of life impact of refractive correction; RS: Refractive surgery.

Postoperative VA of one eye or both eyes of 22 (2.60%) recruits was below 20/25. Thirty-eight (5.81%) recruits complained of persistent dry eye symptom, 62 (10.11%) recruits complained of severe glare and night vision disturbance, 63 (10.24%) recruits complained of distant VA decrease. A few recruits had two or several complaints. In all, 158 (25.69%) recruits had adverse complaints and the mean overall QIRC score was 45.85±6.66 and the lowest score was only 30.94. Using Student's *t*-test, when compared with the mean overall QIRC score of all recruits underwent RS, there was statistical difference ( $t=5.28$ ,  $P<0.01$ ) and question 1, 2, 3, 4, 5, 6, 9, 10, 11, 12, 13 and 18 showed significant difference (Table 4).

## DISCUSSION

Patients' QoL after RS had been evaluated in previous studies<sup>[4-11]</sup>. Pesudovs *et al*<sup>[4]</sup> compared QoL of pre-presbyopic individuals with refractive correction by spectacles, contact lenses and RS, and found QoL was lowest in spectacle wearers (the mean QIRC score was 44.1±5.9), while RS patients scored significantly better (50.2±6.3). Garamendi *et al*<sup>[5]</sup> measure QoL outcome in pre-presbyopic myopic patients having LASIK surgery, overall QIRC scores improved from a mean of 40.07±4.30 to 53.09±5.25 and greater improvements occurred in women (53.83±5.46) than in men (49.39±5.94). Jeong *et al*<sup>[6]</sup> examined changes in vision-related QoL after implantable

Collamer lens (ICL) implantation for the correction of myopia, the QIRC scores increased from 40.45±4.83 preoperative to 53.79±5.60 postoperatively. Meidani *et al*<sup>[7]</sup> investigated QoL outcomes of FS-LASIK using QIRC questionnaire of the Greek version, and the total QIRC score improved from mean 38.9±5.7 preoperatively to 53.7±5.1 postoperatively. However, there were nearly no reports about military members. More, all reports stressed more on improvement of QoL after RS and did not pay much attention to the difference of subgroups of these postsurgical people, only Garamendi *et al*<sup>[5]</sup> noticed sexual difference that women reported a better overall QIRC score after RS than men.

The percentage of Chinese soldiers underwent RS was increasing steadily in recent years. Unlike military members of some other country, most Chinese myopic soldiers must undergo RS to meet the VA standards (above 20/50 in the right eye and 20/63 in the left eye) of conscription before enlisted. As a result, the investigated recruits underwent different types of RS procedure in different time and different RS clinic, which enabled us to study more about QoL of subgroups.

It was interesting that recruits with low myopia preoperatively scored best and those with high myopia scored worst, just like the outcome of myopic patients without RS<sup>[4]</sup>. The reason is that patients with medium and high myopia had more

postoperative complications than low myopia ones, though their UCVA was corrected. Shojaei *et al*<sup>[12]</sup> evaluated 8-year results of PRK for myopia, the percentage of emmetropia within  $\pm 0.5$  D were 69.64%, 44.44%, and 45.65% in the low, moderate, and high myopic group, and corneal haze occurred especially in medium and high myopic groups. Kojima *et al*<sup>[13]</sup> evaluated the outcomes of LASIK surgery, the postoperative uncorrected VA in the low myopia group was statistically significantly better than in the high myopia group and more eyes in the low myopia group (84.7%) than in the high myopia group (56.9%) achieved a spherical equivalent within  $\pm 0.5$  D. As a result, it is better to reduce the percentage of high myopia recruits in the army even though their VA was corrected by RS. Recruits of postoperative interval no more than 6mo scored exactly the same as that of more than 6mo, although we expected that recruits' QoL would be better after 6mo postoperatively. Kato *et al*<sup>[14]</sup> investigated the histopathological changes of rabbit corneas after LASIK and the corneal wound healing process, periodic acid Schiff (PAS) positive material and disorganized collagen fiber were seen along the interface of the corneal flap even 9mo after operation. Linna *et al*<sup>[15]</sup> investigated morphological changes in the rabbit corneal nerves after LASIK, 2.5 and 5mo postoperatively an increasing number of regenerating nerve leashes was observed to emerge from the cut stromal nerve trunks, and the epithelial, basal epithelial and anterior stromal innervation had gained an almost normal nerve density and architecture. It seemed that the corneal would recover to nearly normal state in at least 6mo postoperatively. However, recovery of the optical quality seemed faster. Jung and Lim<sup>[16]</sup> evaluated the optical quality after LASIK and PRK, optical quality three months postoperatively showed no difference from preoperative optical quality in either group, and optical quality recovered within one week after LASIK but took between one and three months to recover after PRK. Reilly *et al*<sup>[17]</sup> observed clinical outcomes of PRK, LASEK and Epi-LASIK in moderately to highly myopic eyes at postoperative days of 1, 4 and 7 and at postoperative months 1, 3, 6 and 12, visual recovery was similar by 4wk and was better with PRK early. So, QoL after RS would reach the highest peak not too long after the surgery. New type of surgical procedure showed no more superiority in term of QoL. In general, a new type of surgical procedure was always correcting the fault of the old one. LASIK surgery, having the merit of less pain, faster recovery and less haze, took the place of PRK in most cases and became the most popular RS in just a few years<sup>[18]</sup>. Pajic *et al*<sup>[19]</sup> compared a femtosecond laser with a microkeratome for flap creation during LASIK in terms of flap thickness predictability and visual outcomes, and femtosecond laser was superior to microkeratome-assisted LASIK. Denoyer *et al*<sup>[20]</sup> compared

SMILE versus LASIK for post-refractive dry eye disease, the SMILE procedure has a less pronounced impact on the ocular surface and corneal innervations, so reduced the incidence of dry eye disease. Nevertheless, the QoL scores showed no difference in all types of surgical procedure. The reason could be that most myopia patients chose RS for glasses-free, and all types of RS procedure could easily help the patients achieve this goal. Bailey *et al*<sup>[21]</sup> evaluated the reasons patients who have had LASIK recommend it to others. "No more spectacles/contact lenses" was listed by 42% patients, followed by "better vision" (21%) and "convenience" (15%)<sup>[21]</sup>. Score of surface surgery seemed a little worse than other types of procedure, though there was no statistics difference because the number was not enough. It could be due to that patients underwent surface surgery recovered more slowly than those underwent lamellar ablation. More, surface surgery was mostly used for patients having no adequate corneal thickness for lamella surgery in China. Patients without adequate corneal thickness always meant most of them had relatively higher degree of myopia, and the previous part of the study showed recruits with low myopia preoperatively scored the best.

Postoperative complications decreased the QoL of recruits, which were also concerned in other studies<sup>[4-5]</sup>. Pesudovs *et al*'s<sup>[4]</sup> study showed 6.7% of refractive surgery patients experienced postoperative complications, which impacted QoL ( $37.86 \pm 2.13$ ). There were postoperative complications after RS just like other surgeries. Solomon *et al*<sup>[22]</sup> reviewed 1581 articles of LASIK surgery and calculated that the patient satisfaction rate after myopic LASIK was 95.3% in all. However, the number of patients underwent RS was so great that the remanded dissatisfied patients (4.7%) were also a considerable number. In the battle field, a slight mistake could mean injuries and deaths, even loss of the battle. Therefore, it is better that soldiers with postoperative complications should stand off important issues that need good visual function.

Although the QIRC questionnaire is an effective instrument for quality of life assessment of refractive correction, there is a little difficulty for Chinese people due to economic and culture difference. For example, the first question was "How much difficulty do you have driving in glare conditions?" while in China, only a few people drive cars. Question 3 "How much trouble is not being able to use off-the-shelf (non-prescription) sunglasses?" had the same trouble that most Chinese seldom wear sunglasses. The places mentioned in question 6 and 7 such as beach, sea, pool and gym were seldom patronized by most Chinese people. As a result, total QIRC score of recruits after RS in this investigation was a little lower than those of other studies<sup>[5-7]</sup>, so some detailed information in the questionnaire should be revised to be easily understood and accepted when translated to Chinese version. The Greek

version of QIRC questionnaire showed no such problems when used by Meidani *et al*<sup>[7]</sup>, possibly because the economy and culture were similar to that of English countries.

In all, the QoL of recruits after RS was fine except those with postoperative complications. Preoperative low myopia recruits had better QoL than high myopia recruits. The QoL of recruits with postoperative interval more than 6mo showed no better than that of less than 6mo and there was no difference of each type of RS procedure. The QIRC questionnaire is a useful instrument for assessing QoL of recruits after RS.

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