Eye (2011) 25, 1194–1201

www.nature.com/eye

CLINICAL STUDY

Visual and non-visual factors associated with patient satisfaction and quality of life in LASIK

P Lazon de la Jara[1,2,3], D Erickson[4], P Erickson[5] and F Stapleton[1,2,3]

Abstract

Purpose **The aim of this study was to determine how laser *in situ* keratomileusis (LASIK) affects quality of life (QOL) and to identify factors that may affect satisfaction after LASIK.**

Methods **A total of 104 patients with a mean age of 29 ± 6, treated with LASIK for myopia and astigmatism, were enrolled in a prospective study. High (90%) and low (10%) contrast visual acuity (CVA) were measured under photopic and scotopic conditions before surgery and at 3 months later. A multidimensional QOL scale (Institute for Eye Research multidimensional QOL scale), which assesses psychological characteristics, personality traits, cosmesis, frequency, and tolerance to disturbing visual and ocular symptoms, and overall satisfaction with vision correction, was also used. Paired rank tests were used to compare preoperative and postoperative vision and QOL scores. Correlations and a multiple linear regression were used to describe the relationship between CVA, QOL, and satisfaction after LASIK.**

Results **Significant postoperative changes included increased satisfaction following LASIK ($P<0.001$), reduced frequency of visual and ocular symptoms ($P<0.001$), and change in psychological characteristics ($P=0.033$). The change in satisfaction with LASIK can be predicted by a combination of preoperative satisfaction, postoperative frequency of disturbing visual and ocular symptoms, postoperative mean spherical equivalent, and postoperative scotopic high CVA ($R^2=0.725$, $P<0.05$).**

Conclusions **Satisfaction with LASIK is related to visual function, preoperative expectations, psychological characteristics, and uncorrected CVA achieved. An increased sense of subjective well-being, adaptability, and self-efficacy was evident after LASIK. Patients reported a more optimistic attitude to life and increase perceived QOL after surgery.**

Eye (2011) **25,** 1194–1201; doi:10.1038/eye.2011.151; published online 1 July 2011

Keywords: quality of life; vision performance; LASIK; psychological characteristics; satisfaction

[1]The Vision Cooperative Research Centre, Sydney, New South Wales, Australia

[2]Brien Holden Vision Institute, Sydney, New South Wales, Australia

[3]School of Optometry and Vision Science, The University of New South Wales, Sydney, Sydney, New South Wales, Australia

[4]Department of Academic Affairs, Lock Haven University, Loch Haven, PA, USA

[5]Adventus Technology, Irvine, CA, USA

Correspondence: P Lazon de la Jara, The Vision Cooperative Research Centre, UNSW, PO Box 6327, Sydney, New South Wales 1466, Australia
Tel: +61 2 9385 7456; Fax: +61 2 9385 7401.
E-mail: p.lazon@visioncrc.org

Received: 20 October 2010
Accepted in revised form: 28 April 2011
Published online: 1 July 2011

Introduction

Quality of life (QOL) refers to a multitude of subjective experiences important to people's lives.[1] Health-related QOL, as described by Guyatt *et al*,[2] has been adopted for all those parameters that need to be measured in clinical trials beyond the traditional outcomes of death and physiological measures of disease activity. In a later publication, Jackowski and Guyatt[3] expressed that these measures encompass a broad spectrum of items, including daily life activities and the degree of satisfaction derived from doing them. Moreover, Muldoon *et al*[4] described that, in health care research, QOL must seek essentially two kinds of information, the functional status of the individual and the patient's appraisal of health as it affects his or her QOL.

Dividing health into physical and mental domains provides some further structure for understanding the effects of health status on QOL.[4] Usually self-assessment questionnaires are used in the evaluation of QOL and reflect the health status from the patient's perspective.

QOL assesses different dimensions that include physical status, functional abilities,

psychological state and well-being, and social interaction. The physical status alludes to symptoms related to the disease, treatment, or results of surgery. The functional abilities refer to an individual's ability to perform daily activities; related to mobility and self-care. The psychological state describes the emotional status, perception of well-being, life satisfaction, and happiness. Negative and positive effects of an illness are assessed in this dimension. The negative effects include the level of anxiety, depression, guilty, and worry. As a result of the medical or surgical intervention, positive emotional states may produce improvement in the emotional functioning, such as joy, vigour, and hopefulness. In addition, satisfaction represents the perception of well-being and indicates general satisfaction. Social interaction includes relationships with other people and social environments, and refers to a person's ability to interact in different activities with family and friends in their social network.[3,5,6]

In a comprehensive review, Wrosch and Scheirerf[7] discuss the effect of personality on QOL. They concluded that personality traits have fundamental role in the perceived QOL that can influence the way people approach life and affect levels of subjective well-being. In addition, they reported that optimism contributes to a person's perceived QOL. Optimism and subjective well-being are related to positive mood, coping, and faster rate of physical recovery. Furthermore, they support that optimists differ from pessimists in the way they handle challenging situations, and show relatively high levels of positive adjustment to change and to overall perceived QOL.

The ophthalmic community has increased their interest in developing appropriate QOL instruments for the correction of refractive error.[8–14] Some dissonance has been found between high levels of satisfaction and the presence of visual disturbances, especially night vision symptoms with refractive surgery, as in one study, a third of patients experienced night vision symptoms yet almost all subjects responded that they would recommend laser *in situ* keratomileusis (LASIK) to a friend.[15] These seemingly contradictory trends point to the fact that other factors than visual performance have an important role in patient satisfaction after refractive surgery. Issues such as psychological factors and personality traits that may influence satisfaction and perceived QOL with LASIK should therefore be investigated.

The aim of this study was to determine how LASIK affects QOL and to identify factors that may affect satisfaction after LASIK. Assessment of personality traits, psychological factors, and subjective visual functioning with a multidimensional QOL scale, plus objective visual performance, should provide valuable insights into the determinants of patient satisfaction with the outcomes of refractive surgery.

Subjects and methods

Subjects

The subjects participating in this study underwent LASIK for the treatment of myopia or myopic astigmatism. They were recruited at two ophthalmic surgery practices in Lima, Peru. Subject age ranged from 18 to 40 years. The investigation was conducted in accordance with the tenets of the Declaration of Helsinki. Approval by the University of New South Wales Human Research Ethics Committee was obtained for all procedures before the investigation and all subjects were required to sign an informed consent form.

All consecutive patients from these eye clinics were invited to participate in this prospective study. In all, 57 subjects (36-F; 21-M), with a mean age of 31 ± 7 years, were treated with the LaserSight LSX (LaserSight Technologies Inc., Winter Park, FL, USA) for myopia and myopic astigmatism with a preoperative mean spherical equivalent (MSE) of -5.06 ± 2.32 D (range -1.38 D to -14.38 D). In all cases, bilateral LASIK was conducted and an optic zone of 6 mm plus a transition zone of 1 mm was performed (LaserSight group).

A total of 47 subjects (32-F; 15-M), with a mean age of 28 ± 5 years and a preoperative MSE of -4.34 ± 2.10 D (range -1.38D to -10.63D), were treated bilaterally with the Schwind Esiris (Schwind Eye-Tech-Solutions GmbH & Co., KG, Aschaffenburg, Germany) for myopia or myopic astigmatism. All subjects were treated with an optic zone of 6 mm (Schwind group) without a transition zone.

Visual performance tests

Wall mounted logMAR visual acuity (VA) charts, printed at 90 and 10% contrast, were used to measure preoperative binocular habitually corrected and post-LASIK binocular uncorrected contrast visual acuity (UCVA) under photopic and scotopic conditions. The test conditions were presented in the following order: high contrast chart and low contrast chart under photopic conditions; and high contrast chart and low contrast chart under scotopic conditions.

For each condition, the chart was changed to an equivalent one with a different letter sequence. For the low illumination condition, subjects wore a modified welding goggle with neutral density filters ND2 with 60 s allowed for dark adaptation.

Tests were conducted with room illumination controlled by a photometer. The VA charts' luminance

was measured using a Minolta Spotmeter F narrow angle 1° (Minolta Co. Ltd, Osaka, Japan) at a distance of 3.8 m. Photopic condition was $180 \pm 20\,cd/m^2$ and $117 \pm 6.7\,cd/m^2$ and scotopic condition was $2.0 \pm 0.5\,cd/m^2$ and $1.2 \pm 0.15\,cd/m^2$ for the LaserSight and Schwind groups, respectively.

The Institute for Eye Research multidimensional QOL scale for myopia (IER QOL scale)

The IER QOL scale was specifically developed to evaluate QOL in pre-presbyopes with myopia and can be administered rapidly and easily in a practitioner's office.[16] This multidimensional scale assesses physical status, psychological state, personality traits, and cosmesis, which are dimensions associated with a patient's QOL.

The IER QOL scale has the following subscales validated through factor analysis and confirmatory factor analysis:

- Frequency of disturbing visual and ocular symptoms (13 related items).
- Tolerance to disturbing visual and ocular symptoms (13 related items).
- Health Proneness Psychological Traits Questionnaire (HPQ;[17] 10 related items).
- Personality traits (extraversion/introversion; three related items).
- Cosmesis (three related items).[16]

In addition, the scale assesses patient satisfaction with the current treatment for correcting myopia.

The physical status relates to ocular and visual symptoms that a patient experienced with their current correction and the tolerance to these symptoms. The psychological characteristics assessed in the HPQ subscale examines how a patient adjusts to new and different conditions such as surgery (adaptability), how optimistic or pessimistic a person feels when facing a particular situation (subjective well-being), and how strongly the patient believes he/she can succeed in a changing environment (self-efficacy). Personality traits, such as extraversion and introversion, affect how a patient perceives and reports symptoms and cosmesis evaluates the person's view of how the optical correction affects his/her attractiveness.[13,16]

A higher score for the tolerance and frequency of disturbing visual and ocular symptoms subscales indicated poorer performance. Higher scores for the HPQ and personality traits subscales reveal subjects who are more likely to be satisfied with life, adapt to new treatments, have adequate coping strategies, and verbalise symptoms consistent with objective assessments.[18] The cosmesis subscale means appearance was important and the lower the satisfaction subscale score, the higher satisfaction perceived by the patient.

Patients initially completed the IER QOL scale Spanish Version[18] onsite during the preoperative screening, and at the 3rd month follow-up appointment post LASIK.

Of particular interest was to measure preoperative binocular habitual corrected VA and binocular UCVA post LASIK to compare those results with QOL dimensions. In that way, each subject acted as their own control for visual performance and for QOL before and after LASIK.

The sample size was estimated to detect a significant improvement, on average, of 0.5 units in the subscales of the IER QOL scale after LASIK. The per-item standard deviation of the change in IER QOL scale across subscales ranges from 0.4 to 0.9. Per-item standard deviation was used as each subscale had varying number of items. A minimum sample size of 27 patients was established based on estimates of type I error $\alpha = 0.05$, for a power of 80% assuming a null hypothesis that there were no differences before and after LASIK.

Data analysis

Before combining data from both sites, preoperative demographic factors and QOL were compared between the LaserSight and Schwind groups. Further, data from both samples were pooled and compared for differences between preoperative and postoperative visual performance and to test for QOL differences between preoperative and postoperative stages. Change in overall satisfaction was determined by calculating the difference between preoperative and postoperative scores of satisfaction.

Pearson's and Spearman's correlations were used to determine the relationship between postoperative visual performance, preoperative and postoperative QOL, and satisfaction variables.

Stepwise multilinear regression analysis was conducted to produce an equation to predict satisfaction with LASIK based on the variables studied. The independent variables entered in the equation were the ones with the strongest correlation with the dependent variable. The order of entry was determined by the statistical criteria generated by the stepwise procedure to identify the better predictors. To avoid multicollinearity, the performance of the model was monitored by the variance inflation factor. A value of over 5 indicates multicollinearity of the model. The Durbin–Watson test was used to analyse serial correlation in the residuals. A value of 2.0 indicates that there is no serial correlation.

Data from patients who did not show up for their 3rd month appointment were considered missing data and excluded from the analysis.

SPSS for Windows 11.5 (SPSS Inc., Chicago, IL, USA) software was used for the analysis.

Results

Preoperative demographics and QOL between groups

There was no significant difference in gender or preoperative spherical equivalent between both groups; however, age was significantly different (LaserSight group: 31.2 ± 6.3 years old *vs* Schwind group 28.1 ± 4.9 years old, $P = 0.01$). There were no statistically significant differences before the surgical procedure between groups ($P > 0.05$) for all the IER QOL subscales, except for the tolerance to disturbing visual and ocular symptoms subscale ($P = 0.026$). Data from both samples were pooled to compare refractive and QOL outcomes before and after LASIK.

Attempted correction

The refractive procedure was highly effective in reducing myopia and astigmatism for both groups. The best-corrected postoperative MSE when both groups were combined was −0.21 ± 0.41 D (range: +0.50 D to −3.25 D). In all, 91% achieved a postoperative MSE within ±0.50 D of emmetropia and 9% of subjects were under-corrected by >0.50 D.

The IER multidimensional QOL scale for myopia

A total of 101 patients from the two refractive surgery centres (LaserSight group $n = 56$ and Schwind Group $n = 45$) completed the Spanish version of the IER QOL scale before and after LASIK. Three patients were excluded from the analysis because of incomplete questionnaires.

There were no statistically significant differences before and after the surgical procedure for the total score of tolerance of disturbing visual and ocular symptoms, cosmesis, and extraversion/introversion subscales of the IER QOL scale ($P > 0.05$).

There was a significant increase in postoperative satisfaction (preoperative 14.4 ± 2.1 *vs* postoperative 8.3 ± 2.9; $P < 0.001$; lower scores in this subscale indicate higher levels of satisfaction), a significant reduction in the frequency of disturbing visual and ocular symptoms (preoperative 24.6 ± 7.6 *vs* postoperative 20 ± 6.6; $P < 0.001$), and a significant increase in the HPQ subscale score (preoperative 31.6 ± 3.9 *vs* postoperative 32.6 ± 4.3; $P = 0.033$) 3 months post LASIK.

Factors affecting overall satisfaction post LASIK

Pearson's correlation revealed a significant correlation between overall satisfaction post LASIK and frequency of ocular and visual symptoms post LASIK ($r = -0.592$, $P < 0.001$).

Postoperative satisfaction and postoperative frequency of disturbing visual and ocular symptoms were the only subscales of the IER QOL scale moderately correlated with postoperative photopic high contrast VA and low contrast VA, and scotopic high contrast VA and low contrast VA (Table 1). The better the visual performance post LASIK, the higher satisfaction and less visual and ocular symptoms experienced by LASIK patients.

Stepwise multilinear regression analysis was performed to determine those variables most predictive of change in satisfaction. The change in satisfaction could be predicted by a combination of preoperative satisfaction, postoperative frequency of disturbing visual and ocular symptoms, postoperative MSE (D) and postoperative scotopic high CVA (HCVA; logMAR), which were statistically significant. A lower level of preoperative satisfaction was the strongest predictor of change in overall satisfaction 3 months after LASIK, accounting for 50% of variability. Postoperative frequency of disturbing visual and ocular symptoms accounted for 16% of variability, 4% by postoperative MSE, and 3% by scotopic HCVA. The following equation describes the relationship between these factors and accounts for 73% of the variance in the change of satisfaction ($r = 0.852$).

Change in satisfaction = −3.772 + 1.093 (preoperative satisfaction) −0.182 (postoperative frequency*) + 1.642 (postoperative MSE) −6.074 (postoperative scotopic HCVA)

(*Postoperative score of frequency of disturbing visual and ocular symptoms IER QOL subscale.)

Postoperative visual performance

Postoperative binocular UCVA (logMAR) for HCVA under photopic conditions was significantly better than the habitual optical correction before LASIK, but the magnitude of the difference was not of clinical relevance. Postoperative binocular UCVA for low CVA (LCVA) under scotopic conditions was lower than the habitual optical correction before LASIK. No significant change was found in photopic LCVA and scotopic HCVA between the habitual preoperative VA and at 3 months postoperative UCVA (Table 2).

Discussion

In general, QOL surveys aim to detect changes over time and differences between groups elicited through instruments that are valid, reliable, responsive, and sensitive.[19] This study assessed preoperatively and

Table 1 Spearman's correlations between postoperative photopic and scotopic visual acuity, and postoperative satisfaction and frequency of disturbing visual and ocular symptoms IER QOL subscales scores

Postoperative IER QOL subscales		*Postoperative photopic visual acuity*		*Postopertaive scotopic visual acuity*	
		High contrast	*Low contrast*	*High contrast*	*Low contrast*
Postoperative satisfaction	ρ^a	0.465	0.460	0.545	0.416
	P	<0.001	<0.001	<0.001	<0.001
Postoperative frequency of disturbing visual and ocular symptoms	ρ^a	0.485	0.577	0.499	0.379
	P	<0.001	<0.001	<0.001	<0.001

Abbreviation: IER QOL, Institute for Eye Research multidimensional quality of life.
[a]Spearman's rank-order correlation coefficient.

Table 2 Differences in binocular visual performance between the preoperative habitually corrected VA and postoperative LASIK uncorrected visual acuity

Visual performance (n = *96*)	*Preoperative (habitual Rx VA, logMAR)*		*Post-operative (UCVA, logMAR)*		P-*value*
	Mean (D)	*SD*	*Mean (D)*	*SD*	
Photopic high-contrast VA	0.05	0.09	0.03	0.08	0.025
Photopic low-contrast VA	0.20	0.12	0.19	0.11	0.504
Scotopic high-contrast VA	0.29	0.11	0.31	0.11	0.078
Scotopic low-contrast VA	0.62	0.13	0.69	0.15	<0.001

Abbreviations: LASIK, laser *in situ* keratomileusis; UCVA, uncorrected contrast visual acuity; VA, visual acuity.

postoperatively personality traits, psychological factors, subjective visual functioning, and satisfaction with a multidimensional QOL scale[16] plus objective measurements of visual performance under photopic and scotopic conditions with habitual vision before and after LASIK. The aim was to determine how the refractive procedure affects QOL and to identify factors that may affect satisfaction after LASIK. The rationale for using a multidimensional QOL scale is that the method (contact lenses, spectacles or refractive surgery) of correcting refractive error will influence QOL.

Owing to the similar preoperative demographics (except for age) and QOL outcomes (except for the tolerance to disturbing visual and ocular symptoms subscale), and as previously reported by Twa *et al*,[20] that no significant differences are attributable to differing excimer lasers used in LASIK, data were combined for the two laser treatment groups to obtain a robust result.

As expected, LASIK was effective in reducing the amount of refractive error in this cohort of patients. It is important to note that most patients enrolled in this study were not wearing their best-corrected VA (BCVA) optical correction. The approach in this study of measuring preoperative binocular habitual corrected VA and binocular UCVA post LASIK than BCVA is more closely aligned to the real visual experience of this patient sample. In that way, each subject acted as their own control for visual performance and for QOL before and after LASIK. We expect that the data gathered, and the assessment of QOL and preoperative habitual corrected VA and UCVA post LASIK, will reflect patients' real life experiences.

The IER QOL scale detected changes in the frequency of visual symptoms, psychological state (HPQ Subscale), and in overall satisfaction with UCVA after LASIK. As expected, patient tolerance towards the visual problems, extraversion/introversion, and cosmesis scores did not change.[16] These variables of the IER QOL scale were intended chiefly for patient selection and for understanding what types of problems patients may be encountered once treatment had started.

The reduction in the frequency of disturbing visual and ocular symptoms and the improvement on the HPQ subscale score reported after LASIK have an important role in the QOL perceived by the myopic patient. This outcome confirms previous findings that reasons other than VA, refractive error, or age are related to patient satisfaction post LASIK,[21] especially predisposing attitudes pre-surgery.[7]

The psychological states that the IER QOL scale assesses on the HPQ subscale are adaptability, self-efficacy, and subjective well-being. The increase in adaptability, sense of confidence, and sense of well-being found in this group after LASIK corroborate the hypothesis proposed by Erickson *et al*,[12] that factors other

than vision, such as psychological variables, contribute to patient perception of QOL in refractive surgery for the correction of myopia. The improvement in the HPQ subscale score indicates that patients reported a more positive or optimistic attitude to life after the surgery. Moreover, optimists are able to handle challenging situations and show relatively high levels of QOL.[7] These data are in agreement with other QOL studies of subjects undertaking LASIK surgery[13] that show increased QOL of myopic subjects post LASIK compared with similar cohorts who choose not to undertake surgery.

Postoperative satisfaction was found to correlate with UCVA after LASIK in agreement with previous studies that demonstrated reduced postoperative UCVA due to residual refractive error as a common reason for dissatisfaction.[22–24]

The regression analysis between selected subsets in the IER QOL scale and objective clinical data showed a significant association between the change in satisfaction post-LASIK and preoperative satisfaction, postoperative frequency of disturbing visual and ocular symptoms, postoperative MSE, and postoperative scotopic HCVA. Patients dissatisfied with their preoperative optical correction showed higher levels of change in satisfaction if a reduction in the frequency of disturbing symptoms, low levels of post MSE, and good levels of scotopic VA were achieved after LASIK. However, postoperative MSE and postoperative scotopic HCVA had a minor role (6% of variability) in the change in satisfaction post LASIK. These data suggested that dissatisfied patients seeking LASIK who have higher levels of disturbing visual and ocular symptoms were more likely to be satisfied if adequate levels of UCVA were achieved with the procedure. The overall satisfaction after LASIK improved and our results were consistent with previous findings.[25–30]

VA measures at all contrast levels were moderately associated with the frequency of disturbing visual and ocular symptoms subscale of the IER QOL scale. From these results, we can hypothesise that VA as tested was only describing part of the possible visual difficulties during the patient's daily activities. This finding confirms the importance of including QOL and self-assessment measures for refractive error during the preoperative and postoperative examinations in refractive surgery, with the aim to collect valuable and additional information regarding visual status.

The Cognitive Dissonance Theory refers to a psychological process that creates a change in attitudes and behaviour to maintain a cognitive consistency towards their beliefs.[17] This effect will be more pronounced when patients pay a fee for the operation, and the surgery is irreversible,[31,32] although, if the surgery involves new technology, the placebo effect will increase.[31] It has been proposed[31] that the measurement of QOL and the use of nonspecific questions, where patients do not directly link their answers to the outcome of the procedure, diminishes the effect of dissonance. However, in this study, we believe that the reduction in the frequency of disturbing visual and ocular symptoms detected by the IER QOL scale and the positive attitude to life encountered after LASIK are factors that favourably influence the level of satisfaction achieved.

The preoperative and postoperative assessment of objective and self-reported clinical data using such questionnaires clearly offers a more comprehensive assessment of the QOL and visual function of the patient than visual measures alone. The complexity of the relationship between satisfaction, QOL, and visual outcomes after LASIK is illustrated by the finding that the HPQ subscale scores increased post LASIK. It suggests that the success of the refractive procedure might positively influence the patient's psychological characteristics. The higher postoperative subscale scores indicate that subjects perceive a stronger ability to adapt to new situations or treatments, feel more optimistic, and develop additional problem-solving strategies in their daily activities and life.[16] This increased perceived QOL is related to overall increased positive mood and coping after surgery. These findings reinforce the importance of psychometric tools in the assessment of refractive surgery patients.

The QOL dimensions assessed in combination with contrast VA performance under photopic and scotopic conditions make this study unique. The multidimensional characteristic of the IER QOL scale gives a better understanding of the influence of different factors that affect patients' perceptions. The assessment and measurement of QOL in refractive surgery covering visual functioning and psychological issues provide valuable additional information about patient outcomes, which are not detected by traditional standards of UCVA, achieved correction and satisfaction.

The implementation of valid and reliable specific QOL instruments for refractive surgery and well-controlled vision tests under photopic and scotopic conditions will provide refractive surgeons with important information before and after the refractive procedure.

In summary, the levels of UCVA and perceived visual function achieved are more important than the change in refractive error induced by the surgical procedure. Satisfaction with LASIK is mainly related to the improvement in visual function, patients' preoperative expectations, psychological characteristics, and UCVA achieved.

Summary

What was known before

- Overall, high levels of satisfaction have been found after laser *in situ* keratomileusis (LASIK).
- Some disparity has been reported between high levels of satisfaction and the presence of visual disturbances after LASIK.

What this study adds

- The administration of a multidimensional quality of life (QOL) tool before and after LASIK, which provides valuable insights about patient satisfaction with LASIK.
- Changes in psychological states before and after LASIK perceived by patients.
- Other factors beyond vision, such as psychological variables that contributes to patient perception of QOL and satisfaction after LASIK.

Conflict of interest

The authors declare no conflict of interest.

Acknowledgements

This study was supported by the Australian Federal Government through the Cooperative Research Centre for Eye Research and Technology, Sydney, Australia, and Vision Cooperative Research Centre, Sydney, Australia. We thank refractive surgeons: Dr Miguel Asmat from Centro de Cornea, Catarata y Glaucoma, Lima, Peru, and Dr Luis Izquierdo from Oftalmo Salud Insituto de Ojos, Lima, Peru, for their support in conducting this study at their Eye Clinics and Dr Judith Flanagan for her review and feedback on the final stages of this manuscript.

References

1 Wiklund I, Dimenas E, Wahl M. Factors of importance when evaluating quality of life in clinical trials. *Control Clin Trials* 1990; **11**(3): 169–179.
2 Guyatt G, Feeny D, Patrick D. Issues in quality-of-life measurement in clinical trials. *Control Clin Trials* 1991; **12**(4 Suppl): 81S–90S.
3 Jackowski D, Guyatt G. A guide to health measurement. *Clin Orthop* 2003; **413**: 80–89.
4 Muldoon MF, Barger SD, Flory JD, Manuck SB. What are quality of life measurements measuring? *BMJ* 1998; **316**(7130): 542–545.
5 Patrick DL, Chiang YP. Measurement of health outcomes in treatment effectiveness evaluations: conceptual and methodological challenges. *Med Care* 2000; **38**(9 Suppl): II14–II25.
6 Naughton MJ, Shumaker SA. The case for domains of function in quality of life assessment. *Qual Life Res* 2003; **12**(Suppl 1): 73–80.
7 Wrosch C, Scheier MF. Personality and quality of life: the importance of optimism and goal adjustment. *Qual Life Res* 2003; **12**(Suppl 1): 59–72.
8 Brunette I, Gresset J, Boivin JF, Boisjoly H, Makni H. Functional outcome and satisfaction after photorefractive keratectomy. Part 1: development and validation of a survey questionnaire. *Ophthalmology* 2000; **107**(9): 1783–1789.
9 Brunette I, Gresset J, Boivin JF, Pop M, Thompson P, Lafond GP *et al*. Functional outcome and satisfaction after photorefractive keratectomy. Part 2: survey of 690 patients. *Ophthalmology* 2000; **107**(9): 1790–1796.
10 Vitale S, Schein OD, Meinert CL, Steinberg EP. The refractive status and vision profile: a questionnaire to measure vision-related quality of life in persons with refractive error. *Ophthalmology* 2000; **107**(8): 1529–1539.
11 Berry S, Mangione CM, Lindblad AS, McDonnell PJ. Development of the National Eye Institute refractive error correction quality of life questionnaire: focus groups. *Ophthalmology* 2003; **110**(12): 2285–2291.
12 Erickson DB, Stapleton F, Erickson P, du Toit R, Giannakopoulos E, Holden B. Development and validation of a multidimensional quality-of-life scale for myopia. *Optom Vis Sci* 2004; **81**(2): 70–81.
13 Pesudovs K, Garamendi E, Elliott DB. The Quality of Life Impact of Refractive Correction (QIRC) Questionnaire: development and validation. *Optom Vis Sci* 2004; **81**(10): 769–777.
14 Pesudovs K, Garamendi E, Elliott DB. The Contact Lens Impact on Quality of Life (CLIQ) Questionnaire: development and validation. *Invest OphthalmolVis Sci* 2006; **47**(7): 2789–2796.
15 Bailey M, Michell L, Dhaliwal D, Boxer Wachler B, Zadnik K. Patient satisfaction and visual symptoms after laser *in situ* keratomileusis. *Ophthalmol* 2003; **110**: 1371–1378.
16 Erickson D, Stapleton F, Erickson P, Giannakopoulous E, Wilson C. The development and validation of the health proneness questionnaire. *J Clin Psych Med S* 2006; **13**: 411–419.
17 Wood W. Attitude change: persuasion and social influence. *Annu Rev Psychol* 2000; **51**: 539–570.
18 Lazon de la Jara P, Erickson D, Erickson P, Stapleton F. Pre-operative Quality of Life and psychological factors that influence patient decision making in LASIK. *Eye (Lond)* 2010; **24**(2): 270–275.
19 Nichols JJ, Mitchell GL, Saracino M, Zadnik K. Reliability and validity of refractive error-specific quality-of-life instruments. *Arch Ophthalmol* 2003; **121**(9): 1289–1296.
20 Twa MD, Lembach RG, Bullimore MA, Roberts C. A prospective randomized clinical trial of laser *in situ* keratomileusis with two different lasers. *Am J Ophthalmol* 2005; **140**(2): 173–183.
21 Nichols JJ, Twa MD, Mitchell GL. Sensitivity of the National Eye Institute Refractive Error Quality of Life instrument to refractive surgery outcomes. *J Cataract Refract Surg* 2005; **31**(12): 2313–2318.
22 Jaycock PD, O'Brart DP, Rajan MS, Marshall J. 5-year follow-up of LASIK for hyperopia. *Ophthalmology* 2005; **112**(2): 191–199.
23 Schmidt GW, Yoon M, McGwin G, Lee PP, McLeod SD. Evaluation of the relationship between ablation diameter, pupil size, and visual function with vision-specific quality-of-life measures after laser *in situ* keratomileusis. *Arch Ophthalmol* 2007; **125**(8): 1037–1042.
24 Levinson BA, Rapuano CJ, Cohen EJ, Hammersmith KM, Ayres BD, Laibson PR. Referrals to the Wills Eye Institute Cornea Service after laser *in situ* keratomileusis: reasons

for patient dissatisfaction. *J Cataract Refract Surg* 2008; **34**(1): 32–39.
25 Knorz MC, Wiesinger B, Liermann A, Seiberth V, Liesenhoff H. Laser *in situ* keratomileusis for moderate and high myopia and myopic astigmatism. *Ophthalmology* 1998; **105**(5): 932–940.
26 McGhee CN, Craig JP, Sachdev N, Weed KH, Brown AD. Functional, psychological, and satisfaction outcomes of laser *in situ* keratomileusis for high myopia. *J Cataract Refract Surg* 2000; **26**(4): 497–509.
27 Balazsi G, Mullie M, Lasswell L, Lee PA, Duh YJ. Laser *in situ* keratomileusis with a scanning excimer laser for the correction of low to moderate myopia with and without astigmatism. *J Cataract Refract Surg* 2001; **27**(12): 1942–1951.
28 McDonald MB, Carr JD, Frantz JM, Kozarsky AM, Maguen E, Nesburn AB *et al*. Laser *in situ* keratomileusis for myopia up to -11 diopters with up to -5 diopters of astigmatism with the summit autonomous LADARVision excimer laser system. *Ophthalmology* 2001; **108**(2): 309–316.
29 Miller AE, McCulley JP, Bowman RW, Cavanagh HD, Wang XH. Patient satisfaction after LASIK for myopia. *Clao J* 2001; **27**(2): 84–88.
30 Hill JC. An informal satisfaction survey of 200 patients after laser *in situ* keratomileusis. *J Refract Surg* 2002; **18**(4): 454–459.
31 Homer JJ, Sheard CE, Jones NS. Cognitive dissonance, the placebo effect and the evaluation of surgical results. *Clin Otolaryngol* 2000; **25**(3): 195–199.
32 Bailey MD, Mitchell GL, Dhaliwal DK, Wachler BS, Olson MD, Shovlin JP *et al*. Reasons patients recommend laser *in situ* keratomileusis. *J Cataract Refract Surg* 2004; **30**(9): 1861–1866.