Vision-related quality of life and visual function after retinal detachment surgery

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With the improved anatomical success rate of surgery for rhegmatogenous retinal detachment (RD), increasing attention has been directed toward the quality of postoperative vision.[1-6] Even after the successful retinal reattachment, the postoperative visual function may be unsatisfactory in some cases. In addition to the traditional objective assessments of patients, such as clinical examinations and laboratory data collection, subjective assessment of the daily activities and well-being of patients has become increasingly important in recent medical practice. For the quantitative evaluation of the vision-related quality of life (VR-QOL), the 25-Item National Eye Institute Visual Function Questionnaire (VFQ-25)[7] has been used to track the outcome of many ocular diseases such as cataract, glaucoma, age-related macular degeneration, epiretinal membrane, diabetic retinopathy, keratoconus, and macular hole.[8-16] As RD is an acute-onset, unstable, and progressive disease, it is difficult to evaluate preoperative VR-QOL in patients with RD. On the other hand, assessment of postoperative daily activities and well-being of patients after RD surgery are feasible and of clinical importance. To the best of our knowledge, however, no reports have addressed VR-QOL in patients after RD surgery. We conducted the current prospective study to evaluate VR-QOL and visual function after surgery for RD.

Methods

Patients

We included 51 eyes of 51 consecutive patients with RD who were successfully treated with scleral buckling procedure or pars plana vitrectomy. Surgery was performed at our clinic by an experienced vitreoretinal surgeon (F.O.) from January 2006 through February 2007. There were 38 males and 13 females, and their age averaged 51.9 ± 13.8 years (mean ± SD). The control group comprised 46 age-matched normal subjects (age 52.3 ± 3.9 years). We conducted this study in accordance with the tenets of the Declaration of Helsinki, and the study protocol was approved by the institutional review committees of Tsukuba University Hospital. Prior to inclusion in the study, all patients provided written informed consent after the nature of the study was explained to them. Exclusion criteria included previous history of ocular surgery in the study eye and ophthalmic disorders except for refractive errors. Eyes with complicated vitreoretinal disease such as proliferative vitreoretinopathy and RD resulting from giant retinal tears, macular hole, or ocular trauma were also excluded. The following preoperative information was obtained for each patient: age, gender, logarithm of the minimum angle of resolution best-corrected visual acuity (logMAR BCVA), type of detachment, number of retinal breaks, and clock hours of detachment. Data regarding characteristics of patients with RD and normal controls are presented in Table 1. Age and gender did not significantly differ between both groups. The indications for pars plana vitrectomy included RD for horseshoe tears due to posterior vitreous detachment, while the indications for scleral buckling included detachment caused by atrophic hole with lattice degeneration.

LogMAR BCVA and contrast sensitivity were obtained at 6 months postoperatively. We tested 2 indices of contrast sensitivity function; contrast sensitivity using CSV-1000E chart and low contrast visual acuity using CSV-1000LanC10% chart (Vector Vision Co., Greenville, OH). These tests were performed with the best spectacle correction.

The CSV-1000E, which was used to test contrast sensitivity, provides a fluorescent luminance source that retroilluminates a translucent chart and automatically calibrates to 85 cd/m^2. Four spatial frequencies, namely, 3, 6, 12 and 18 cycles/degree (cpd), were present, and each spatial frequency included 8 different levels of contrast. The test was performed monocularly in the undilated state at 2.5 m. With the patients' manifest refraction in place, the patients identified the rows and 8 columns of patches. The patients were asked to identify the grating pattern in each column. The contrast level of the last correct response was recorded as the contrast threshold in logarithmic values.[17] From the data obtained by CSV-1000E, the area under the log contrast sensitivity function (AULCSF) was calculated according to the method of Applegate et al**.**[18] The log of contrast sensitivity was plotted as a function of log spatial frequency, and third-order polynomials were fitted to the data. The fitted function was integrated between the fixed log spatial frequency limits of 0.48 (corresponding to 3cpd) and 1.26 (18cpd), and the resulting value was defined as the AULCSF.

The CSV-1000LanC10%, which was used to evaluate low contrast visual acuity, is based on the Early Treatment Diabetic Retinopathy Study (ETDRS) chart (The Lighthouse, New York, NY). Although the original ETDRS chart uses alphabets as optotypes under 100% high contrast, this system uses Landolt rings as optotypes under 10% low contrast. This test was performed monocularly with undilated pupils at 2.5 m distance.

The patients' eyes were classified into 2 groups based on the type of surgical procedures; 33 eyes were treated with pars plana vitrectomy and 18 eyes with scleral buckling. The buckling surgery consisted of cryopexy and circumferential silicone sponge buckling (#506, MIRA, Walthom, MA). The encircling was performed using a silicone band (#240, MIRA) or a silicone sponge (#506G, MIRA). Subretinal fluid drainage and sulfur hexafluoride (SF_6) gas injection was performed when required. Combined cataract surgery and standard 20-gauge vitrectomy was performed in all patients in the pars plana vitrectomy group. The surgical technique comprised a vitrectomy that released vitreous traction around the breaks, internal drainage of the subretinal fluid, a total gas-fluid exchange using 20% SF_6, and endolaser photocoagulation. In both treatment groups, patients who were injected with gas were instructed to maintain a facedown position during the first 1 postoperative week.

The 25-item National Eye Institute Visual Function Questionnaire (VFQ-25)

The patients were requested to self-administer VFQ-25 at 6 months postoperatively to assess VR-QOL. Preoperative evaluation of VFQ-25 was not performed because RD is a rapid-onset ocular disorder. The research staff explained the questionnaire to the patients, verbally administered the instructions, and provided assistance when required. The completed questionnaires were reviewed for missing data by the research staff. The patients with RD and normal controls were instructed to rate the level of difficulty in terms of particular visual symptoms or vision-related daily activities.

VFQ-25 is composed of 12 vision-targeted scales: general health, general vision, ocular pain, near activities, distance activities, social functioning, mental health, role difficulties, dependency, driving, color vision, and peripheral vision. [7] Each scale consisted of a minimum of 1 and maximum of 4 items. The standard algorithm was used to calculate the scale scores, which have a possible range from 0 to 100. [7] The higher the score, the better the VR-QOL pertinent to that specific symptom/activity. The composite score was calculated by averaging the scores of 11 subscales; the “general health” subscale was excluded.[7] In this study, the Japanese version of VFQ-25 was used which was modified to suit the Japanese culture and lifestyle. This modified VFQ-25 has been assessed for its reliability and validity and has been proven to measure VR-QOL accurately in Japanese individuals.[8]

Statistical analysis

The mean scores and standard deviations were calculated for each VFQ-25 subscale as well as for the VFQ-25 composite score. A Mann-Whitney *U* test was performed to compare each subscale score and composite score between the RD group and normal controls. The same test was also used to compare age, visual acuity, contrast sensitivity, and the VFQ-25 composite score between the pars plana vitrectomy group and scleral buckling group. The relationship between questionnaire scores and visual acuity, contrast sensitivity, age, number of retinal breaks, and clock hours of detachment were examined by the Spearman rank correlation test. To correlate visual acuity with the questionnaire score, the logMAR BCVA worse than 1.6 was determined as follows: counter fingers, 2.00; hand motions, 2.30; and light perception, 2.60.[19,20] All tests were considered statistically significant if $P < 0.05$. The analyses were carried out using StatView (version 5.0, SAS Inc., Cary, NC).

Results

All patients had unilateral RD and surgery only in the RD eye during the perioperative and 6-month postoperative period. No significant intraoperative and postoperative complications were observed, such as subretinal hemorrhage, persistent elevation of intraocular pressure for more than 3 days, cystoid macular edema, and choroidal detachment. Retinal reattachment was attained at initial operation in all eyes. In the scleral buckling group, SF_6 gas was injected in 4 patients (22.2%), and subretinal fluid drainage was performed in 9 patients (50.0%), and there was no cataract formation. In the pars plana vitrectomy group, 20% SF_6 gas was injected in all patients. At 6 months postoperatively, logMAR BCVA was 0.06 ± 0.23, AULCSF was 0.97 ± 0.25, and low contrast visual acuity was 0.50 ± 0.26. A relationship between preoperative and postoperative logMAR BCVA based on macular-on or macular-off retinal detachment status in each eye is shown in Figure 1. In all cases, RD surgery was performed in their similarly- or worse-seeing eye. The logMAR BCVA in the fellow eye was –0.07 ± 0.05.

The results of VFQ-25 subscales and the composite scores in the RD group and normal controls are shown in Table 2. The VFQ-25 composite score was significantly lower in the RD patients (80.3 ± 12.5) than in the normal controls (85.2 ± 10.2, $p < 0.05$). The RD group showed significantly lower scores than the normal controls in 4 subscales, near activities, mental health, dependency, and peripheral vision.

No correlation was observed between the VFQ-25 composite score and postoperative logMAR BCVA in the operated eye (Figure 2), but the VFQ-25 composite score exhibited significant correlation with AULCSF and low contrast visual acuity in the operated eye (Figure 2). The VFQ-25 composite score did not show any significant relationship with preoperative logMAR BCVA ($r = –0.128$, $p = 0.372$), age ($r = 0.138$, $p = 0.496$), number of retinal breaks ($r = –0.007$, $p = 0.966$), and clock hours of detachment ($r = –0.070$, $p = 0.641$). The VFQ-25 composite score did not correlate with logMAR BCVA and the contrast sensitivity in the fellow eye.

The preoperative logMAR BCVA in the macular-off retinal detachment group (0.83 ± 0.62) was significantly worse than that in the macular-on group (-0.04 ± 0.05, $p < 0.0001$). Further, The postoperative logMAR BCVA in the macular-off group (0.13 ± 0.26) was significantly worse than that in the macular-on group (-0.06 ± 0.06, $p < 0.001$). However, there was no difference between the postoperative VFQ-25 composite score in the macular-off group (78.8 ± 12.1) and that in the macular-on group (83.2 ± 13.1, $p = 0.17$).

Discussion

As shown in the results, in patients with RD even after successful reattachment surgery, VR-QOL is at a lower level than the normal controls. Specifically, the score of 4 subscales were significantly lower in the RD group than in the normal controls, such as near activities, mental health, dependency, and peripheral vision. Although visual acuity in the RD patients was almost normal after reattachment surgery (logMAR BCVA 0.06 in this study), their VR-QOL was found to be deteriorated. Previous studies have reported that the mean VFQ-25 composite scores after surgery in patients with macular hole, epiretinal membrane and age-related macular degeneration were 82.4, [15] 83.3,[9] and 54.4, [14] respectively. The mean VFQ-25 composite score after RD surgery in this study (80.3) was similar to those after macular hole and epiretinal membrane surgery and higher than that after macular translocation surgery for age-related macular degeneration.

We found that the VFQ-25 composite score significantly correlated with contrast sensitivity, but not with visual acuity. Visual acuity is widely recognized as a major determinant of VR-QOL, and in fact ophthalmologists rely primarily on visual acuity to plan patient management.[21] Many studies have shown that visual acuity correlates with VR-QOL.[9,15,20-23] However, visual acuity can be a poor predictor of many aspects of visual function.[24,25] Contrast sensitivity has been shown to correlate with various aspects of activities requiring vision, including orientation, mobility, reading speed, and driving.[26,27] Carta et al reported that contrast sensitivity was strongly associated with VR-QOL, even with adjustment for visual acuity among ophthalmic patients with chronic eye conditions such as age-related macular degeneration.[28] In other studies, VFQ-25 responses correlated with contrast sensitivity as well as visual acuity in patients with diabetes mellitus and age-related macular degeneration.[11,21] It is noteworthy that contrast sensitivity was significantly associated with VR-QOL in patients after RD surgery.

The VFQ-25 composite score correlated with visual function in the operated eyes, but not in the fellow eyes. Since the worse- or similarly-seeing eyes were operated on in all cases in our study, these results indicate that VR-QOL was associated with visual function in the worse-seeing eye. These results are not consistent with several previous reports. Miskala et al investigated VR-QOL in patients with subfoveal choroidal neovascularization using VFQ-25, and they demonstrated that changes in the overall and subscale scores are linearly related to changes in visual acuity of the better-seeing eye but not of the worse-seeing eye.[22] Deramo et al investigated VR-QOL in patients with unilateral central retinal vein occlusion and observed that the VFQ-25 responses correlated with visual acuity in the better-seeing eye.[20] In other studies, the VFQ-25 responses correlated with binocular visual acuity in patients with macular hole and epiretinal membrane.[9,15] A significant relationship between VR-QOL and the visual function of the worse-seeing eye has not been reported until now. At present, we do not have clear explanation for this discrepancy, but there are two speculations. First, since RD is a rapid-onset disease, patients do not have enough time to get accustomed to the condition in which daily life is largely dependent on the better-seeing eye. In case of chronic and slowly-progressive diseases, patients may gradually adjust themselves to the condition in which the function of the better-seeing eye plays a major role in daily activities. Second, the mean visual acuity in the worse-seeing eye (logMAR BCVA 0.06 in this study) was rather higher than in other vitreoretinal diseases (e.g., macular hole, age-related macular degeneration, and epiretinal membrane). It may be that small difference in visual function between the better- and worse-seeing eyes was, at least partially, responsible for the current results.

We acknowledge certain limitations of our study, including small sample size that may have influenced the relationship between visual function and VFQ-25 scores. Another limitation of our study is the lack of preoperative VFQ-25 scores and scores at several times post surgery. Future studies with a larger sample size and time course of changes in VR-QOL will further facilitate our understanding of the relation between VR-QOL and visual function in patients undergoing surgery for RD.

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Figure legends

Figure 1. Visual acuity preoperatively and 6 months after surgery for retinal detachment.

Macular off, eyes in which the fovea was involved in the retinal detachment before surgery; macular on, eyes in which the fovea was not involved.

Figure 2. National Eye Institute 25-Item Visual Function Questionnaire (VFQ-25) composite score vs. postoperative visual acuity and contrast sensitivity in the operated eye in patients with retinal detachment.

(Top left) VFQ-25 composite score vs. logarithm of the minimum angle of resolution best-corrected visual acuity (logMAR BCVA): $r = –0.172$, $p = 0.229$. (Top right) VFQ-25 composite score vs. the area under the log contrast sensitivity function (AULCSF): $r = 0.354$, $p < 0.05$. (Bottom left) VFQ-25 composite score vs. low contrast visual acuity: $r = –0.475$, $p < 0.001$.