Visual Function and Vision-Related Quality of Life after Vitrectomy for Epiretinal Membranes: A 12-Month Follow-up Study

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Purpose. To evaluate the effect of removing epiretinal membranes (ERMs) on visual function and vision-related quality of life (VR-QOL) for 12 months postoperatively.

Methods. Idiopathic ERMs were removed during vitrectomy in 26 eyes. The VR-QOL was evaluated using a self-administered 25-item National Eye Institute Visual Function Questionnaire before (baseline) and 3 and 12 months postoperatively. During the same periods, the best-corrected visual acuity (BCVA), central macular thickness (CMT), and metamorphopsia score were recorded.

Results. At baseline and months 3 and 12, the logMAR BCVAs (mean ± SEM) were 0.41 ± 0.05, 0.17 ± 0.04 ($P = 0.0001$ versus baseline), and 0.10 ± 0.03 ($P < 0.0001$ versus baseline, $P = 0.0016$ versus month 3), respectively; the CMTs (μm) were 402 ± 18, 312 ± 9 ($P < 0.0001$ versus baseline), and 300 ± 7 ($P < 0.0001$ versus baseline, $P = 0.0544$ versus month 3); and the metamorphopsia scores were 202 ± 29, 137 ± 27 ($P = 0.0186$ versus baseline), and 108 ± 26 ($P = 0.0005$ versus baseline, $P = 0.0218$ versus month 3). In 23 (88%) of 26 eyes, the BCVA improved more than 0.1 logMAR unit at month 12. The improved BCVA was correlated with improvements in two subscales ($r = -0.405$ to -0.574, $P = 0.0041$–0.0427) at month 3; the improved metamorphopsia score was correlated with the improved composite score ($r = -0.552$, $P = 0.0058$) and three subscales ($r = -0.458$ to -0.507, $P = 0.0113$–0.0219) at month 12.

Conclusions. Removing ERMs improved visual function, anatomy, and the VR-QOL. Three months postoperatively, the improved BCVA was the most important factor related to the improved VR-QOL, although the simultaneous cataract surgery might have had a confounding effect. The improved metamorphopsia was the important factor associated with improved VR-QOL 12 months postoperatively. (www.umin.ac.jp/ctr number, UMIN000000617.) (*Invest Ophthalmol Vis Sci.* 2012;53:3054–3058) DOI:10.1167/iovs.11-9153

The prevalence rates of epiretinal membranes (ERMs) have been reported to range from 5.3% to 18.5% in the general population and to be 35% in patients aged 70 to 79 years.[1–4] ERMs are cellular avascular proliferations on the retinal surface that can decrease visual acuity (VA) and cause metamorphopsia as a result of retinal wrinkling resulting from traction in the macular region.[5] Since Machemer[6] first reported removing ERM during vitrectomy in 1978, favorable postoperative visual outcomes have been reported,[6–10] but the visual function was evaluated mainly based on VA in those studies. However, in patients with an ERM, metamorphopsia, rather than decreased VA, frequently is the reason for undergoing surgery. Therefore, traditional ophthalmologic measurements such as VA may not reflect patient satisfaction with the postoperative visual function.

The 25-item National Eye Institute Visual Function Questionnaire (VFQ-25) is used to evaluate vision-related quality of life (VR-QOL).[11] Recently, studies of the postoperative VR-QOL using the VFQ-25 have included patients with various diseases, such as macular holes, retinal detachments, and proliferative diabetic retinopathy.[12–15] Two studies have assessed the VR-QOL before and after surgical removal of ERMs; however, both studies evaluated the VR-QOL during relatively short periods of 3 or 4 months postoperatively.[16,17] After ERM removal, continuous improvements in VA, retinal thickening, and metamorphopsia have been observed for up to several years[9,18,19]; thus, longer follow-up might provide additional information regarding patient satisfaction related to ERM removal.

The goals of the current study, therefore, were to evaluate the visual function and VR-QOL and assess the relationship between visual function and VR-QOL for up to 12 months postoperatively in patients who underwent ERM surgery.

Subjects and Methods

Subjects

The institutional review board of Shimane University Hospital approved this study. All subjects signed an informed consent form that complied with the tenets of the Declaration of Helsinki. The study protocol was registered in the University Hospital Medical Information Network (UMIN) Clinical Trials Registry (http://www.umin.ac.jp/ctr/index-j.htm) (UMIN000000617) before the start of the study. Twenty-six eyes of 26 consecutive Japanese patients with an idiopathic ERM who underwent pars plana vitrectomy at Shimane University Hospital between November 2006 and January 2009 were prospectively recruited into the study. The diagnosis of an idiopathic ERM was based on observations by funduscopy, slit-lamp biomicroscopy, and optical coherence tomography (OCT). To exclude a possible secondary ERM, eyes with a history of previous intraocular surgeries (except for small-incision cataract surgery without intraocular complications), uveitis, and vitreoretinal diseases, such as retinal breaks and diabetic retinopathy, were excluded. Except for idiopathic ERMs and mild cataract, patients also were excluded if they had any other ocular pathologies that might affect VA.

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Table 1. BCVA, CMT, and Metamorphopsia Score at Each Time Point

	Time Point			*P* Value*		
	Baseline	**Month 3**	**Month 12**	**Baseline vs. Month 3**	**Baseline vs. Month 12**	**Month 3 vs. Month 12**
BCVA (logMAR)						
Mean ± SE	0.41 ± 0.05	0.17 ± 0.04	0.10 ± 0.03	0.0001†	< 0.0001†	0.0016‡
CMT (μm)						
Mean ± SE	402 ± 18	312 ± 9	300 ± 7	< 0.0001†	< 0.0001†	0.0544
Metamorphopsia score						
Mean ± SE	202 ± 29	137 ± 27	108 ± 26	0.0186§	0.0005†	0.0218§

* *P* values were calculated using the Wilcoxon signed-rank test.
† $P < 0.001$.
‡ $P < 0.01$.
§ $P < 0.05$.

Assessment of Visual Function and Anatomy

Three parameters, i.e., the best-corrected visual acuity (BCVA), central macular thickness (CMT), and metamorphopsia, that were related to visual function or anatomy were assessed before (baseline) and 3 and 12 months postoperatively. The BCVA was measured using a decimal VA chart and converted to the logarithm of minimal angle of resolution (logMAR) VA. The CMT in the central 1-mm diameter subfield was measured using the 3D-OCT 1000 Mark 2 (Topcon, Tokyo, Japan) with an area scan covering a 6 × 6-mm macular region (512 pixels × 128 horizontal line scans). Metamorphopsia was evaluated using the Amsler chart, and the number of distorted squares on the charts was recorded as the metamorphopsia score.[12,16]

VR-QOL Questionnaire

To assess the VR-QOL, the VFQ-25 questionnaire was self-administered before (baseline) and 3 and 12 months postoperatively. Members of the research staff explained the questionnaire to the patients and provided verbal instructions and assistance when required. After the patients completed the questionnaire, the research staff members reviewed it for missing items. The VFQ-25 is composed of 25 items in which patients are asked to assess the level of difficulty of particular visual symptoms or day-to-day activities. The following is an example: "Because of your eyesight, how much difficulty do you have noticing objects off to the side while you are walking?" Each item was assigned to 1 of 12 subscales: general health, general vision, ocular pain, near activities, distance activities, social functioning, mental health, role difficulties, dependency, driving, color vision, and peripheral vision. The subscale score was converted to a score between 0 and 100, with 100 indicating the highest possible function or minimal patient impairment. The VFQ-25 composite score was calculated as the mean score of all items, except for general health items.[11] We used the Japanese version of the VFQ-25, which was modified for use with Japanese individuals. The reliability and validity of the Japanese VFQ-25 were reported previously.[20]

Surgical Procedures

One of two experienced vitreous surgeons (Y.M. and Y.T.) performed the surgeries (sutureless 25-gauge three-port vitrectomy). After a posterior vitreous detachment was created and the posterior vitreous membrane removed, the ERM was removed from the macula using a hooked 25-gauge needle and/or microforceps under a magnified contact lens. Patients scheduled for cataract extraction before vitrectomy underwent a conventional phacoemulsification procedure with IOL implantation through a 2.75-mm clear corneal incision.

Statistical Analysis

All statistical analyses were performed using StatView software (version 5.0, SAS Institute Inc., Cary, NC). All continuous data except for age (mean ± SD) were expressed as the mean ± SE, as they did not show Gaussian distribution. The BCVA, CMT, metamorphopsia score, each VFQ-25 subscale, and the composite scores were compared between each pair of three time points using the Wilcoxon signed rank test. The relationships between changes in the VFQ-25 scores (month 3–baseline or month 12–baseline) and changes in visual function parameters (month 3–baseline or month 12–baseline) were analyzed using the Spearman's rank correlation test. $P < 0.05$ was considered statistically significant.

Results

Twenty-six eyes of 26 consecutive subjects (10 men, 16 women; mean age, 70 ± 9 years; range, 55 to 82 years) were prospectively included in this study. Among the 26 eyes, 22 were phakic and four were pseudophakic. All phakic patients underwent simultaneous cataract surgery and vitrectomy. The ERM was removed successfully in all subjects; no significant complications, such as retinal breaks, retinal detachments, subretinal hemorrhages, or endophthalmitis, occurred intraoperatively or postoperatively. All patients completed the follow-up examinations at months 3 and 12.

Table 1 shows the BCVA, CMT, and metamorphopsia score at each time point. Compared with the baseline values, all three parameters improved at month 3 and improved more at month 12; the differences in all three parameters between baseline and month 3 ($P = 0.0186$ – $P < 0.0001$) and between baseline and month 12 ($P = 0.0005$–$P < 0.0001$) were significant, and in the BCVA ($P = 0.0016$) and the metamorphopsia score ($P = 0.0218$) between months 3 and 12. The BCVA improved more than 0.1 logMAR unit in 19 (73%) of 26 eyes at month 3 and 23 (88%) of 26 eyes at month 12. The metamorphopsia scores decreased compared with baseline in 18 (69%) of 26 eyes at months 3 and 19 (73%) of 26 eyes at month 12, and the CMT decreased in 24 (92%) of 26 eyes at months 3 and 12.

Table 2 shows the VFQ-25 scores at each time point. All subscales were equal to or higher than baseline at month 3 and were the highest at month 12; the differences reached significance between baseline and month 3 for general vision ($P = 0.0251$), near activities ($P = 0.0073$), role difficulties ($P = 0.0062$), and composite score ($P = 0.0170$), and between baseline and month 12 for general vision ($P = 0.0050$), near activities ($P = 0.0006$), distance activities ($P = 0.0273$), mental health ($P = 0.0107$), role difficulties ($P = 0.0087$), and composite score ($P = 0.0042$).

Table 3 shows the correlations between the BCVA, CMT, and metamorphopsia score and the VFQ-25 scores. At month 3, the postoperative improvements in the BCVA were correlated with improvements in general health ($r = -0.574$, $P = 0.0041$) and general vision ($r = -0.405$, $P = 0.0427$) subscale scores; no

Table 2. VFQ-25 Scores at Each Time Point

VFQ-25 Questionnaire Scale	Time Point			P Value*		
	Baseline	Month 3	Month 12	Baseline vs. Month 3	Baseline vs. Month 12	Month 3 vs. Month 12
General health	55 ± 3	57 ± 3	61 ± 2	0.3454	0.0752	0.1521
General vision	58 ± 3	66 ± 3	68 ± 3	0.0251†	0.0050‡	0.3135
Ocular pain	80 ± 3	83 ± 3	84 ± 3	0.2895	0.2211	0.8541
Near activities	66 ± 3	76 ± 3	78 ± 2	0.0073‡	0.0006§	0.2093
Distance activities	71 ± 3	75 ± 3	77 ± 3	0.0602	0.0273†	0.3612
Social functioning	84 ± 3	84 ± 2	85 ± 2	0.9718	0.4479	0.2994
Mental health	68 ± 4	74 ± 3	78 ± 4	0.0709	0.0107†	0.1174
Role difficulties	75 ± 3	83 ± 3	85 ± 3	0.0062‡	0.0087‡	0.2084
Dependency	85 ± 4	90 ± 3	90 ± 3	0.1755	0.2623	0.9744
Driving	64 ± 4	71 ± 4	71 ± 4	0.1013	0.1931	0.7199
Color vision	89 ± 3	89 ± 3	89 ± 3	0.7389	0.7389	0.9999
Peripheral vision	65 ± 3	69 ± 3	71 ± 4	0.2482	0.0833	0.5637
Composite score	73 ± 2	79 ± 2	81 ± 2	0.0170†	0.0042‡	0.1442

VFQ-25 scores are expressed as mean ± SE.

* *P* values were calculated by the Wilcoxon signed-rank test.

† $P < 0.05$.

‡ $P < 0.01$.

§ $P < 0.001$.

other correlations between each VFQ-25 score and the three parameters reached significance. At month 12, the postoperative improvement in the metamorphopsia score was correlated with the improvements in general vision ($r = -0.458$, $P = 0.0219$), near activities ($r = -0.507$, $P = 0.0113$), distance activities ($r = -0.477$, $P = 0.0171$), and the composite scores ($r = -0.552$, $P = 0.0058$); no other correlations between the VFQ-25 scores and the three parameters reached significance.

Discussion

Previous studies have reported that the BCVA continued to improve for up to 2.0 to 2.4 years after ERM removal[18,19]; better BCVA compared with preoperatively was achieved in 43%, 54%, and 60% of eyes during 6 to 12 months, 1 to 2 years, and 2 to 3 years, respectively, after ERM removal, whereas cataracts progressed after vitrectomy occurred in 57% of phakic eyes.[9] Metamorphopsia, one of the main symptoms of an ERM, also improved at 3 months or later after ERM removal, which was assessed using the Amsler chart,[16] M-Charts,[17] Sine Amsler charts,[21] and scanning laser ophthalmoscopy.[22] Other studies have reported that the CMT decreased for several months after surgery but did not change thereafter.[18,23] Thus, improvements in visual functions and anatomy, especially VA and metamorphopsia after surgical removal of an ERM, can continue for longer than 3 months and reach the best values at about 1 year. These results agreed well with the results of the current study (Table 1).

Vitrectomy resulted in improved VFQ-25 composite scores, and 3 of 12 subscales significantly improved at 3 months postoperatively (Table 2). Previous studies have shown that the postoperative composite score and other subscales significantly improved for 3 or 4 months postoperatively.[16,17] According to these and the current findings, vitrectomy performed to remove an ERM improved the VR-QOL. To the best of our knowledge, however, no report has evaluated using the VFQ-25 to assess the VR-QOL in patients with an ERM later than 4 months after surgery. In the current study, we found that most subscales at month 12 were higher than at month 3 and that the composite score and 5 of 12 subscales at month 12 significantly improved from baseline.

In the current study, we performed cataract surgery combined with vitrectomy in all phakic eyes (85% of subjects); thus, cataract surgery might affect the postoperative improvement in the BCVA at month 3. Previous studies have reported that cataract progression is a reason for the absence of a VA improvement after ERM surgery.[10,16,24] Accordingly, the combination surgery allowed us to evaluate the effect of ERM removal itself on visual functions and VR-QOL for a longer-term follow-up. Actually, further improvement in the BCVA was observed at month 12 compared with month 3; this occurred because of further improvement in the metamorphopsia score after month 3 and was very likely a direct effect of ERM removal.

In the current study, although the metamorphopsia score improved, the change in the composite score was not correlated with the change in metamorphopsia at month 3. Ghazi-Nouri et al.[16] also did not find a significant association between the VFQ-25 composite score and metamorphopsia at month 4; however, Okamoto et al.[17] reported a significant correlation between changes in the VFQ-25 composite score and changes in the severity of the metamorphopsia. Whereas Ghazi-Nouri et al.[16] used the Amsler chart to assess metamorphopsia (as in the current study), Okamoto et al.[17] used M-Charts (Inami & Co., Ltd., Tokyo, Japan), a quantitative evaluation of metamorphopsia that measures the minimal visual angle of the dotted line at which patients aware of metamorphopsia. Thus, the difference in methodology may explain the discrepancy. The current study, however, found the most significant correlation between the changes in the composite score and the changes in the metamorphopsia score at month 12. During the same period, the changes in metamorphopsia were significantly correlated with changes in 3 of 12 subscales. Although the improvement in the BCVA was even more evident than the improvement in the metamorphopsia score at month 12, no significant correlation was observed between changes in the BCVA and changes in any VFQ scores. Taken together with the previous studies, the current findings suggested that among the visual function and anatomic parameters, the improvement in metamorphopsia, even if its improvement was smaller than the improvements of other parameters, was associated most strongly with the

Table 3. Correlation between Changes in VFQ-25 Scores and Changes in BCVA, CMT, and Metamorphopsia Score

VFQ-25 Questionnaire Scale	Changes from Baseline to Month 3*			Changes from Baseline to Month 12†		
	VFQ-25 vs. BCVA (logMAR)	VFQ-25 vs. CMT (μm)	VFQ-25 vs. Metamorphopsia Score	VFQ-25 vs. BCVA (logMAR)	VFQ-25 vs. CMT (μm)	VFQ-25 vs. Metamorphopsia Score
General health						
r	−0.574	0.098	−0.243	−0.154	−0.138	−0.133
P value	0.0041‡	0.6238	0.2252	0.4418	0.4888	0.5075
General vision						
r	−0.405	0.003	−0.225	−0.347	−0.128	−0.458
P value	0.0427§	0.9876	0.2606	0.0828	0.5217	0.0219§
Ocular pain						
r	−0.334	0.091	0.089	−0.11	0.27	−0.182
P value	0.0947	0.6476	0.6555	0.5826	0.1773	0.3626
Near activities						
r	−0.131	0.361	−0.21	−0.258	0.034	−0.507
P value	0.5118	0.0713	0.2936	0.1968	0.8658	0.0113§
Distance activities						
r	−0.004	0.102	−0.13	−0.388	−0.122	−0.477
P value	0.8403	0.6106	0.5147	0.0523	0.5427	0.0171§
Social functioning						
r	0.028	0.094	−0.053	−0.302	−0.177	−0.384
P value	0.8881	0.6394	0.7902	0.1306	0.3761	0.0547
Mental health						
r	−0.216	0.245	−0.219	−0.145	−0.05	−0.248
P value	0.281	0.2198	0.2742	0.469	0.8022	0.2144
Role difficulties						
r	−0.063	−0.063	−0.027	−0.196	−0.228	−0.212
P value	0.7532	0.7542	0.8925	0.3263	0.2540	0.2897
Dependency						
r	−0.23	−0.078	−0.026	−0.112	0.118	−0.051
P value	0.2509	0.6954	0.8960	0.5760	0.5550	0.7696
Driving						
r	−0.114	0.145	−0.079	−0.354	−0.083	−0.183
P value	0.6485	0.5629	0.7517	0.1566	0.7409	0.4651
Color vision						
r	0.222	0.044	0.294	−0.018	−0.073	−0.103
P value	0.2662	0.8267	0.1414	0.9284	0.7167	0.6076
Peripheral vision						
r	−0.007	−0.151	−0.271	−0.262	−0.142	−0.088
P value	0.9723	0.4501	0.1748	0.1894	0.4777	0.6617
Composite score						
r	−0.24	0.157	−0.161	−0.339	−0.088	−0.552
P value	0.2304	0.4326	0.4213	0.0901	0.6604	0.0058‡

r, regression coefficient.

* The r and *P* values are calculated by Spearman's rank correlation test between each VFQ-25 score (month 3–baseline) and BCVA (month 3–baseline), CMT (month 3–baseline), or metamorphopsia score (month 3–baseline).

† The r and *P* values are calculated by Spearman's rank correlation test between each VFQ-25 score (month 12–baseline) and BCVA (month 12–baseline), CMT (month 12–baseline), or metamorphopsia score (month 12–baseline).

‡ $P < 0.01$.

§ $P < 0.05$.

improved VR-QOL achieved in patients who underwent vitrectomy to remove an ERM.

The current study had several limitations. Because the patients answered the questionnaire preoperatively and postoperatively, they might have had a desire to please the surgeon or justify the inconvenience after surgery; thus, patients might have tended to answer the questionnaire more positively after surgery. However, the effects of such a bias would have become weaker at month 12 than soon after the surgery at month 3. A relatively small sample size might have had an effect on the power of the study. Another limitation was the absence of a control group. For this study, patients with a visually relevant ERM who underwent only cataract surgery would have been ideal controls to cancel the bias in the surgery itself and the effect of visual improvement resulting from cataract surgery. It is difficult to include such a group, however, because we ethically cannot perform cataract surgery alone on patients with an ERM who have visually relevant metamorphopsia and follow them for longer periods. This is why the control group was absent or incomplete in this and previous studies.[16,17]

In conclusion, the current study suggested that surgical removal of ERMs improved visual function and VR-QOL. The improvement in metamorphopsia was the most important factor associated with better VR-QOL 12 months postoperatively.

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