

SCIENTIFIC REPORT

Visual function and quality of life following vitrectomy and epiretinal membrane peel surgery

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Br J Ophthalmol 2006;**90**:559–562. doi: 10.1136/bjo.2005.085142

Aim: To investigate the effect of epiretinal membrane (ERM) peel on patients' health related quality of life (HR-QOL) and to explore the association between self reported HR-QOL and conventional measures of visual function.

Methods: The National Eye Institute 25 Item Visual Function Questionnaire (VFQ-25) and the 36 Item Short-Form Health Survey (SF-36) were self administered by 20 patients before and 4 months following surgery. Preoperative and post-operative data collected included logMAR near and distant visual acuity (VA), contrast sensitivity, and metamorphopsia. Questionnaire scores were compared preoperatively and postoperatively and their correlation with traditional methods of visual function evaluation analysed.

Results: Postoperatively there was no significant improvement in mean logMAR VA. However, eight (40%) subjects improved by two or more ETDRS lines and nine eyes (45%) reached a final VA of 6/18 or better. Metamorphopsia decreased significantly ($p=0.019$) and there was significant improvement in VFQ-25 mean scores for the general vision ($p=0.03$), distance activities ($p=0.05$), and composite score ($p=0.03$). Baseline binocular VA was significantly correlated with baseline VFQ-25 composite score ($r=0.631$, $p=0.004$).

Conclusions: ERM surgery appears to improve patients' subjective perception of visual function as indicated by higher composite scores in VFQ-25 and improved metamorphopsia in the absence of significant improvement in mean logMAR VA.

Epiretinal membranes (ERM) have been described in 5.3% to 18.5%¹⁻⁴ of the population and the incidence increases with age, with 2% incidence at the age of 50 and 20% incidence at the age of 75 by examination of autopsy eyes.⁵ ERMs are bilateral in up to 20% of patients⁶ and can cause metamorphopsia and reduced visual acuity (VA) by several mechanisms including macular distortion, vascular leakage, shallow tractional retinal detachment and opacity from the ERM itself.⁷ Vitrectomy and ERM peel, first performed by Machemer⁸ in 1978, is now a well established procedure with visual acuity (VA) improvement by two Snellen lines in up to 90% of patients.⁹⁻¹⁰ Visually significant recurrence of ERM is being reported at 3%.¹⁰

Despite the wealth of published material regarding the visual outcome of ERM peel, its impact on patients' quality of life (QOL) has not been reported in the literature. Traditional measures of VA may be insufficient to provide necessary information regarding aspects of visual function that may be vital for patients' daily routine activities. Functional assessment and health related quality of life (HR-QOL) surveys are gaining popularity as effective instruments for measuring the

influence of ophthalmic conditions, or treatments on patients' capabilities to perform visual tasks.¹¹⁻¹⁷

The aim of this study was to evaluate the functional and anatomical results of ERM peel and to explore its effect on patients' HR-QOL. Additionally, we analysed the correlation between tests of visual function and perceived visual ability with QOL questionnaires for patients with ERM.

PATIENTS AND METHODS

Patients due to undergo ERM peel at Moorfields Eye Hospital, were recruited prospectively. Suitable individuals passed an abbreviated version of the Folstein Mini-Mental State examination.¹⁸ Exclusion criteria included previous vitreoretinal surgery, coexisting ocular pathology, or those needing combined vitrectomy/cataract extraction.

The study was approved by the local Moorfields Eye Hospital ethics committee and written informed consent was obtained from each participant. Best corrected VA (BCVA) for distance and near was measured at 4 metres and 40 cm, respectively, using two modified ETDRS charts. Metamorphopsia was evaluated by the number of distorted squares on the Amsler chart. Contrast sensitivity (CS) was measured by Pelli-Robson chart at 1 metre.

Cataracts were graded using the Lens Opacities Classification System III (LOCS III) reference standards.¹⁹ Subjects self administered the 25 Item Visual Function Questionnaire (VFQ-25) and 36 Item Short-Form Health Survey (SF-36) questionnaires as previously described.¹⁶ Standard three port pars plana vitrectomy and ERM peel were performed without internal limiting membrane staining or peel.

Subjects were reviewed 1 day, 3 weeks, and 4 months postoperatively. At the 4 month appointment, complete baseline examination was repeated, and patients completed the questionnaires again.

Parametric methods, including independent *t* test, ANOVA, and linear regression, were used for normally distributed variables. Non-parametric tests such as Mann-Whitney U and Wilcoxon signed rank test were used for variables that showed non-normality. Relation of questionnaire scores to VA, metamorphopsia, and CS was examined by Spearman rank correlation. The relation between categorical variables was evaluated using χ^2 test. All tests of association were considered statistically significant if $p<0.05$. No adjustments were made for multiple tests. Analyses were carried out using SPSS version 10.

Abbreviations: BCVA, best corrected visual acuity; CS, contrast sensitivity; ERM, epiretinal membrane; HR-QOL, health related quality of life; LOCS III, Lens Opacities Classification System III; QOL, quality of life; SF-36, 36 Item Short-Form Health Survey; VA, visual acuity VFQ-25, 25 Item Visual Function Questionnaire

Table 1 Baseline characteristics of recruits (20 eyes of 20 patients)

Age (years)	
Range	26–82
Mean (SD)	66 (13)
Sex	
Male	3 (15%)
Female	17(85%)
Spherical equivalent in operated eye	
Range	(–4.25)–(3.0)
Mean (SD)	–0.4 (2.3)
Lens status	
Phakic	16 (80%)
Pseudophakic	4 (20%)
LogMAR near visual acuity in surgery eye (number of letters)	
Range	12–70
Mean (SD)	41 (15)
LogMAR near visual acuity in fellow eye (number of letters)	
Range	37–75
Mean (SD)	60 (9)
Metamorphopsia (mean number of squares on the Amsler chart)	132 (137)
Size of epiretinal membrane,(disc areas)	
Range	4–36
Mean (SD)	12 (8)
Cause of epiretinal membrane	
Idiopathic	17 (85%)
Uveitis	2
Diabetic retinopathy	1

RESULTS

Table 1 summarises baseline characteristics of recruits. Postoperatively four eyes (20%) had mild residual extrafoveal ERM not requiring further surgery. None of the patients had recurrence of the ERM during the study period.

Postoperative BCVA ranged from 6/60 to 6/7.5 (mean 6/24; median 6/24). Despite improvement by a mean of three (13) letters and four (18) letters for distance and near respectively, visual improvement failed to reach statistical significance. However, eight subjects (40%) improved by two or more ETDRS lines and nine eyes (45%) reached a final VA of 6/18 or better.

Eighteen (90%) patients underwent ERM surgery in their worse seeing eye. VA in the fellow eye ranged from 6/4.5 to 6/15 (mean 6/7.5; median 6/6).

Metamorphopsia decreased significantly from a mean of 132 (137) squares at baseline to 70 (106) at the final review ($p = 0.019$). Metamorphopsia improved in 14/20 (70%) eyes with four patients reporting no distortion at the final visit and deteriorated in one eye (5%). Patients with complete removal of ERM were significantly less symptomatic than individuals with subtotal membrane peel ($p = 0.013$).

Despite improvement of metamorphopsia postoperative mean CS was reduced from 1.26 (0.41) log units at baseline to 1.18 (0.36) log units at the final visit but not reaching statistical significance.

Table 2 shows recorded complications and table 3 shows preoperative and postoperative mean subscale scores of questionnaires.

Baseline binocular VA was significantly correlated with baseline VFQ-25 composite score ($r = 0.63$, $p = 0.004$) and subscale scores for general vision ($r = 0.712$, $p = 0.001$), near activities ($r = 0.749$, $p < 0.001$), distance activities ($r = 0.780$, $p < 0.001$), social functioning ($r = 0.667$, $p = 0.002$), mental health ($r = 0.489$, $p = 0.034$), role difficulties ($r = 0.610$, $p = 0.006$), and peripheral vision ($r = 0.481$, $p = 0.037$). Similar significant correlations were also found between final binocular VA and final VFQ-25 scores. There was no

Table 2 Intraoperative and postoperative complication

Complication	Incidence*
Retinal tears†	4/20 (20%)
High intraocular pressure‡	2/20 (10%)
Development of NS¶	8/16 (50%)
Development of PSCOs§	3/16 (19%)
Lens touch	1/16 (6%)
Transient macular oedema	1/20 (5%)

*Incidence of cataract in total; 75%.

†Retinal tears treated at the time of surgery with cryopexy and intraocular gas.

‡Requiring temporary use of apraclonidine eye drops.

¶NS, nuclear sclerosis.

§PSCO, posterior subcapsular opacity.

correlation between metamorphopsia and CS with VFQ-25 scores preoperatively or postoperatively.

The Spearman correlation coefficient between composite VFQ-25 and SF-36 scores at baseline and at the final follow up was statistically significant for most comparisons (table 4). This demonstrates that the former instrument despite being a vision specific measure may capture aspects of QOL that overlap with generic questionnaires.

DISCUSSION

In this study residual postoperative extrafoveal membrane was noted in 20% of patients, which was not considered clinically significant to justify further surgery. Postoperative improvement in distance and near VA failed to reach statistical significance; however, eight patients (40%) experienced improvement of two or more ETDRS lines and nine patients (45%) reached a VA of 6/18 or better. This is in contrast with previously reported improvement in VA by two Snellen lines of up to 90%.^{9, 10} Failure of VA improvement may be related to development of cataract (75%) observed in this study where the end point was 4 months and cataract surgery had not been performed in any cases. In addition, the baseline VA in this series may have been better than in previously published reports making it less likely that a marked VA improvement would be demonstrated. Postoperative cataract progression may also explain reduced CS observed in these patients although the reduction did not reach statistical significance.

ERM surgery in this study was associated with significant ($p = 0.019$) improvement of metamorphopsia in 70% of eyes with four patients (20%) reporting no distortion postoperatively. Distortion is a marked visual symptom produced by ERM and its resolution is often associated with patient subjective satisfaction even if the Snellen VA fails to improve.

There are no previous published reports studying the effect of ERM surgery on patients vision related QOL. Standardised and validated questionnaires (as those used here) have been used to investigate the effect of treatment on patients' QOL in other macular disorders.^{16, 17}

Participants in this study with favourable anatomical postoperative outcome reported a significant improvement in their general and distance vision as measured by VFQ-25 including reading street signs or the name of stores, going down steps, or curbs in dim lights or at night and going out to see movies or sports events. There was also a significant increase in the composite score indicating an overall improvement in vision related activities. These findings are notable since 90% of participants had better distant vision in the fellow eye and one might have expected that the above activities would not be markedly influenced by the modest improvement in VA in the operated eye. This is evidence that the subjective decrease in metamorphopsia, often volunteered by patients following ERM peel and supported by the findings of this study, is the most important benefit of ERM surgery.

Table 3 Summary statistics for VFQ-25 and SF-36 and comparison of the mean subscale and composite scores before and after vitrectomy and ERM peel surgery using paired *t* test

Questionnaire scale	No	Mean (SD) score before ERM surgery	Mean (SD) score after ERM surgery	p Value
VFQ-25				
General health	20	64.5 (24.0)	65.8 (27.9)	0.70
General vision	20	65.6 (16.5)	70.5 (12.2)	0.03*
Ocular pain	20	84.9 (18.0)	86.8 (18.4)	0.60
Near activities	20	68.2 (22.6)	74.6 (24.4)	0.18
Distance activities	20	71.9 (21.2)	79.4 (18.3)	0.05*
Social functioning	20	88.8 (14.4)	94.7 (12.7)	0.06
Mental health	20	72.9 (25.1)	79.5 (22.7)	0.14
Role difficulties	20	73.7 (25.0)	80.6 (26.5)	0.06
Dependency	20	93.1 (14.4)	91.2 (17.0)	0.71
Driving	9	80.8 (19.3)	88.0 (8.4)	0.41
Colour vision	20	88.2 (21.0)	92.1 (11.9)	0.25
Peripheral vision	20	80.3 (27.1)	86.1 (23.0)	0.20
Composite score	20	78.4 (16.4)	83.3 (15.5)	0.03*
SF-36				
Physical functioning	20	74.1 (26.7)	74.2 (32.7)	0.72
Role physical	20	60.5 (46.6)	57.9 (43.3)	0.75
Bodily pain	20	77.6 (26.5)	72.8 (28.7)	0.48
General health	20	72.9 (22.1)	76.9 (15.6)	0.28
Vitality	20	62.5 (23.0)	58.8 (25.5)	0.03*
Social functioning	20	81.2 (27.9)	79.6 (25.8)	0.69
Role emotional	20	84.2 (34.0)	79.6 (34.5)	0.46
Mental health	20	81.6 (13.3)	79.6 (15.8)	0.91

*Statistically significant values (p<0.05).

Table 4 Correlations between SF-36 and VFQ-25 composite score before and after epiretinal membrane surgery

Questionnaire scale	VFQ-25 composite score	
	Baseline <i>r</i> (p value)	Final <i>r</i> (p value)
SF-36		
Physical functioning	0.96 (0.001)*	0.55 (<0.014)*
Role physical	0.76 (<0.001)*	0.60 (0.007)*
Bodily pain	0.56 (0.012)*	0.59 (0.011)*
General health	0.35 (0.137)	0.51 (0.025)*
Vitality	0.59 (0.011)*	0.56 (0.001)*
Social functioning	0.11 (0.643)	0.63 (<0.004)*
Role emotional	0.29 (0.234)	0.31 (<0.217)
Mental health	0.28 (0.257)	0.48 (0.038)*

*Indicates statistical significant results (p<0.05).

In the SF-36 questionnaires, the scores for the vitality domain were reduced significantly postoperatively with subjects reporting feeling tired. This may be the result of other systemic pathologies, particularly in an elderly. However, it is possible that vitreoretinal surgery and the associated postoperative recovery (four patients had intraocular gas and head posturing) is tiring for the elderly and could result in reduced vitality, even 4 months postoperatively. This is of importance when counselling patients for such surgery.

Interestingly, there was no significant association between the VFQ-25 composite score and metamorphopsia before or after surgery although in the group as a whole there was significant reduction in metamorphopsia. We have recently reported a direct correlation between improvement in distortion following macular hole surgery and VFQ-25 composite scores.¹⁶ Failure to demonstrate a similar association here may be because of the smaller sample size of this study; alternatively, a differing nature of distortion experienced by patients with macular hole and those with ERM may account for different effects on their daily activities.

This study has certain limitations—for example, its relatively small sample size and lack of a comparison control

group. We used an Amsler chart to assess metamorphopsia as it is easy to use and patient friendly. However, more sophisticated measurements of metamorphopsia, which were beyond the scope of this study, may yield more detailed results on the effect of metamorphopsia on the QOL.

Notwithstanding these limitations, this study's strengths include its prospective design and the use of validated instruments with detailed recording of our subjects' medical and functional characteristics.

This study for the first time indicates that vitrectomy with ERM peel in the worse seeing eye may bring significant improvement in vision related QOL even if the objective improvement in the VA is only modest. Longer follow up of the study eyes, particularly following cataract surgery, and controlled studies with larger number of eyes would improve our understanding of visual function after vitrectomy and ERM removal.

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Accepted for publication 3 January 2006

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