The Visual Outcome and the Related Factors in Macula off Rhegmatogenous Retinal Detachment*

Makülanın Tutulduğu Regmatojen Retina Dekolmanında Görsel Sonuçlar ve İlişkili Faktörler

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ABSTRACT

Purpose: To assess the factors affecting the visual outcome in macula off rhegmatogenous retinal detachment (RD).

Materials and Methods: Retrospective chart review of the patients who underwent repair for macula off rhegmatogenous RD with minimum 6 month follow-up. Duration of symptoms (DS), clinical findings, surgical method, number of reoperations, optical coherence tomography findings and postoperative complications were recorded.

Results: A total of 28 eyes of 27 patients were included in the study. The mean duration of symptoms was 11.1±9.0 (range, 3-45) days. Twelve eyes (42.9%) underwent scleral buckling whereas 16 eyes (57.1%) underwent pars plana vitrectomy. The mean follow-up time was 23.2±19.4 (range, 6-84) months. Twelve (42.8%) eyes had a final visual acuity (VA) of 20/30 or higher and 17(60.7%) eyes had a final VA of 20/40 or higher. VA significantly increased without any intervention between 12 to 24-month in 10 eyes with longer than 12-month follow-up. The final VA in patients with DS ≤ 7 days was not significantly higher than the patients with DS between 8-14 days (p=0.936) or ≥ 14 days (p=0. 721). The final VA correlated with only initial VA (p=0.046). Initial VA and cystoid macular edema (CME) were found to be the significant independent factors for the final VA (p=0.054 and p=0.004).

Conclusions: Visual outcome could be favorable with DS longer than 1 week in patients with macula off rhegmatogenous RD. Initial VA and CME were the independent factors for the final VA. Visual recovery could continue at least up to 24 months following RD repair.

Key Words: cystoid macular edema, epiretinal membrane, macula off, rhegmatogenous retinal detachment, optical coherence tomography.

ÖZ

Amaç: Makülanın tutulduğu regmatojen retina dekolmanında (RD) görsel sonuçları etkileyen faktörlerin değerlendirilmesi.

Gereç ve Yöntem: Makülanın tutulduğu regmatojen RD nedeniyle ameliyat olan ve en az 6 ay süreyle izlemi bulunan hastaların dosyaları tarandı. Semptom süresi (SS), klinik bulgular, cerrahi yöntem, reoperasyon sayısı, optik koherens tomografi bulguları ve operasyon sonrası komplikasyonlar kaydedildi.

Bulgular: Çalışmaya 27 hastanın 28 gözü dahil edildi. Ortalama semptom süresi 11.1±9.0 (3-45) gündü. On iki göze (%42.9) skleral çökertme, 16 göze (%57.1) pars plana vitrektomi uygulandı. Ortalama izlem süresi 23.2±19.4 (6-84) ay olan çalışmada, sonuç görme keskinliği (GK) 12 gözde (%42.8) 0.7 ve üstü, 17 gözde (%60.7) 0.5 ve üstü saptandı. İzlem süresi 12 ayın üstünde olan 10 gözde, 12-24 ay arasında herhangi bir girişim olmaksızın anlamlı GK artışı izlendi. SS 7 günün altında olan hastaların sonuç GK'nin, SS 8-14 gün arası olan (p=0.936) veya 14 günden uzun olan gözlerden farklı olmadığı görüldü (p=0.721). Başlangıç GK ile sonuç GK arasında anlamlı bir korelasyon saptandı (p=0.046). Başlangıç GK ve kistoid maküla ödeminin sonuç GK'ni etkileyen bağımsız faktörler olduğu izlendi (p=0.054 ve p=0.004).

Sonuç: Makülanın tutulduğu regmatojen RD'nda, SS 1 haftanın üzerinde olan hastalarda başarılı görsel sonuçlar alınabilmektedir. Başlangıç GK ve kistoid makülar ödem, sonuç GK için bağımsız faktörlerdir. RD ameliyatı sonrası görsel iyileşme, operasyon sonrası 24. aya dek sürebilmektedir.

Anahtar Kelimeler: Epiretinal membran, kistoid makülar ödem, makülar dekolman, optik koherens tomografi, regmatojen retina dekolmanı.

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INTRODUCTION

The functional outcome in macula-off rhegmatogenous retinal detachment (RD) cases has been reported to be worse compared with macula-on eyes.[1,2] The suggested factors related to the visual outcome in macula off eyes were the duration of macular detachment, preoperative visual acuity, extension of detached area and macular height.[3-6] By the advances in diagnostic instruments and introduction of optical coherence tomography (OCT), the challenges during the follow-up and the causes for poor visual outcome after successful RD repair became clearer compared to the previous years, yet not fully understood. New predictors of visual outcome are still being searched due to some controversial results regarding the previously suggested factors. A better understanding of the predictors and causative factors with the help of newer instrumention may contribute to better clinical practice about the care of these patients. Our aim in this study was therefore to assess the factors affecting the visual outcome in macula-off RD patients.

MATERIAL AND METHODS

The records of patients who underwent RD repair surgery for primary macula off rhegmatogenous RD were retrospectively reviewed following Institutional Review Board approval. The operations were performed by the same surgeon and enrolled from the Saint Louis University retina service and his private practice. Inclusion criteria was having RD repair surgery for primary macula off rhegmatogenous RD with at least 6 months follow-up. Exclusion criteria included history or presence of any coexistent systemic or ocular problem (diabetic retinopathy, glaucoma, uveitis, age related macular degeneration etc.) that might prevent full visual recovery.

Preoperative data included demographics, duration of preoperative symptoms (DS), lens status, extent of RD and best-corrected visual acuity (BCVA) by Snellen chart. Type of RD repair surgery, the number of additional surgeries, the change in BCVA, postoperative retinal status, complications and OCT findings were recorded. OCT imaging was performed by Cirrus HD-OCT (Cirrus; Carl Zeiss Meditec Inc, Dublin, California, USA) or Stratus OCT (Model 3000, Carl Zeiss Ophthalmic System, Dublin, CA).

For statistical analysis, preoperative and postoperative BCVA were converted to the logarithm of the minimal angle of resolution (logMAR) values. [7] Descriptive statistics were expressed as mean±SD. Comparisons between groups were performed by Students' t test and chi-square was used for comparison of percentages. The Pearson's correlation coefficient was used as a measure of association between normally distributed variables. Multivariate linear regression analysis was used to find out the independent factors associated with final VA. Statistical analysis was performed by SPSS statistical software (SPSS 11.0.0 for MS Windows; SPSS Inc., Chicago, IL).

RESULTS

A total of 28 eyes of 27 patients were included in the study. Table 1 shows the demographics and preoperative ocular characteristics of the patients. Ten (35.7%) eyes had a myopia over 4D. The mean duration of symptoms was 11.1±9.0 (3-45) days. Nineteen (67.9%) eyes had one, 7(25.0%) had two, 2 (7.1%) had three RD repair surgeries. Twelve eyes (42.9%) underwent scleral buckling whereas 16 eyes (57.1%) underwent 20 gauge pars plana vitrectomy as the first surgery. In the vitrectomy group, silicon oil was used in 8 eyes and SF6 was used in 8 eyes as tamponade. The mean time interval between the first and second surgery was 0.8±2.2 (0.50-10) months. The mean follow-up time was 23.2±19.4 (6-84) months and all patients had an attached retina at the final visit.

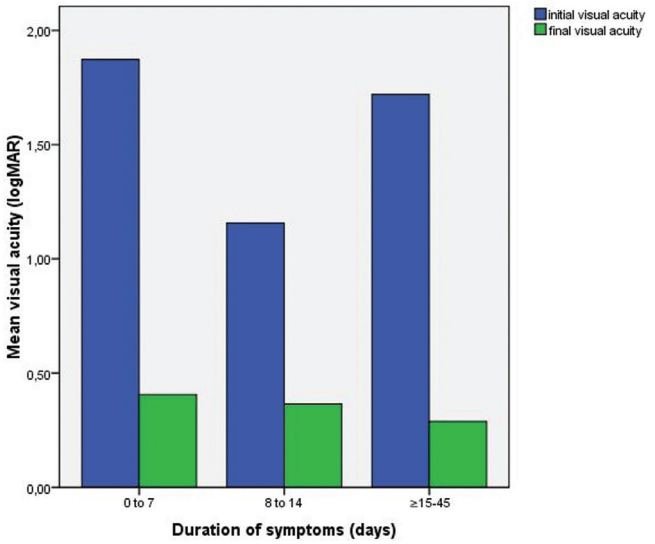
Table 1: *Demographics and preoperative ocular characteristics of the patients.*

	N(%)
Age (mean±SD)	55.9±13.8
Gender	
Female	12 (44.4)
Male	15 (55.5)
Race	
Caucasian	25 (92.5)
African American	1 (3.7)
Hispanic	1 (3.7)
Eye	
Right	15 (53.6)
Left	13 (46.4)
Lens	
Clear lens	8 (28.6)
Cataract	6 (21.4)
Pseudophakic	14 (50)
Number of detached retinal quadrants	
1	6 (21.4)
2	14 (50)
3	2 (7.1)
4	6 (21.4)

Table 2: *The final visual acuity (VA) of the patients according to the duration of symptoms (DS).*

DS (days)	n (%)	Initial VA (LogMAR)	Final VA (LogMAR)	P value	Final VA ≥20/40 n (%)
≤7	11 (39.2)	1.87±0.82	0.40±0.34	P=0.003	6 (54.5)
8-14	12 (42.8)	1.15±0.57	0.36±0.25	P=0.004	7 (58.3)
≥15	5 (17.8)	1.72±0.94	0.28±0.12	P=0.043	4 (80)

P value is 0.936 for the comparison of Final VA between DS≤7 and DS 8-14 groups,
P value is 0.721 for the comparison of Final VA between DS≤7 and DS ≥15 groups.



Graphic: *Graph shows the initial and final visual acuity based on duration of symptoms (p=0.936 for the comparison of final VA between DS≤7 days and DS 8-14 days, P=0.721 for the comparison of final VA between DS≤7 days and DS ≥15 days (One way ANOVA, Turkey).*

Visual Outcomes and Optical Coherence Tomography Findings

The final VA (0.36±0.27) was significantly better than the initial VA (1.53±0.79, p<0.001, paired t test). Twelve (42.8%) eyes had a final VA of 20/30 or higher and 17(60.7%) eyes had a final VA of 20/40 or higher. The final VA did not significantly differ according to DS (Table 2, Graphic). When the eyes which underwent a single operation were analyzed based on the surgery type, the final VA was not significantly different between two groups (0.32±0.13 for scleral buckling and 0.43±0.36 for vitrectomy, p=0.965). The final VA was not significantly higher in patients with one RD repair (0.39±0.30, 19 eyes) compared to patients with 2 or more RD repairs (0.31±0.20, 9 eyes, p=0.579, independent t test). The final VA was significantly higher in eyes with detached retina of 1 or 2 quadrants (0.30±0.21, 20 eyes) versus eyes with detachment larger than 2 quadrants (0.52±0.34, 8 eyes, p=0.045). Eyes with initial VA≥20/800 had better final VA compared to the eyes with initial VA<20/800 (0.27±0.15, 16 eyes versus 0.49±0.34, 12 eyes, p=0.027, chi-square).

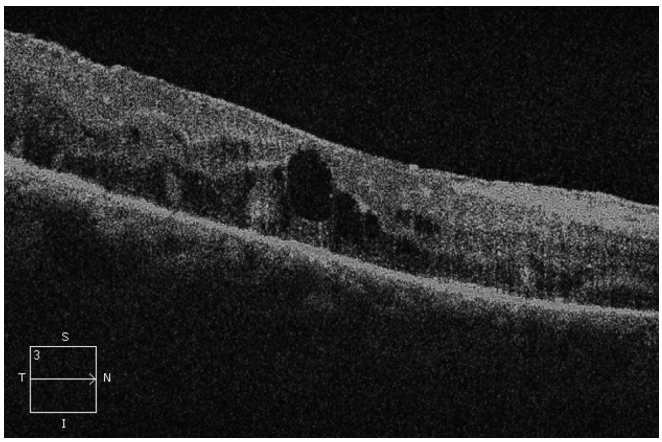


Figure 1: *Spectral OCT shows cystoid macular edema and epiretinal membrane 5 months after PPV. BCVA is 20/200 and central macular thickness is 390 µm.*

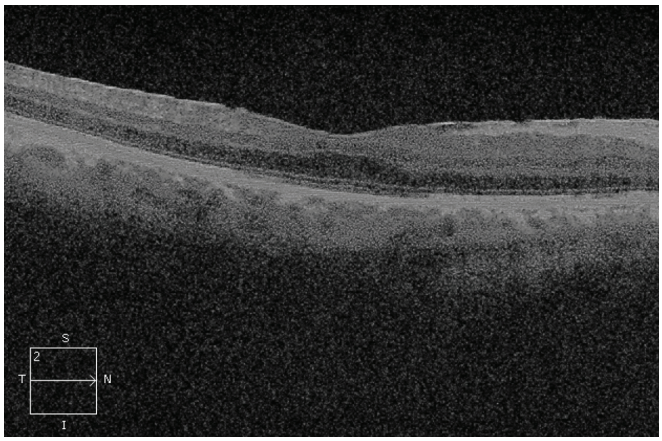


Figure 2: *Spectral OCT shows epiretinal membrane 3 months after PPV. BCVA is 20/50 and central macular thickness is 313 µm.*

Abnormal OCT findings at the final visit were epiretinal membrane (ERM) (6 eyes), cystoid macular edema (CME) (5 eyes), inner/outer segment (IS/OS) junction disruption and pigmentary changes (1 eye), macular hyperpigmentation (1 eye), diffuse central foveal thickening (1 eye), extrafoveal thickening (1 eye) and irregular outer nuclear layer (1 eye) (Figure 1,2). Of 6 eyes which were evaluated with spectral OCT, only 1 eye showed IS/OS disruption with a final VA of 20/60. Six eyes had subretinal fluid (SRF) during the follow-up period and none of them had detectable SRF on OCT at their final visit.

Table 3: *Multivariate lineer regression analysis results for the final visual acuity as dependent variable.*

	R^2: 0.479		
	β	**Std. Error**	**p**
Age	0.106	0.003	0.542
Duration of symptoms	0.049	0.006	0.805
Initial visual acuity	0.319	0.053	0.054
Cystoid macular edema	0.497	0.117	0.004
Epiretinal membrane	0.036	0.107	0.827
Number of retinal detachment repair	-0.110	0.069	0.489
Extent of detached retina	0.291	0.096	0.076

Table 4: *Postoperative complications of the macula off RD patients after RD repair.*

Complications	**N (%)**
Epiretinal membrane	11 (39.2)
High intraocular pressure	9 (32.1)
Cystoid macular edema	7 (25)
Macular hole	1 (3.5)
Vitreus hemorrhage	1 (3.5)
Choroidal hemorrhage	1 (3.5)
Cataract	1 (3.5)

Cystoid macular edema was associated with epiretinal membrane in 3 of 7 eyes

In eyes with a final VA <20/40, 4 out of 11 had a normal OCT profile with no obvious lesions that can cause poor vision. One of 4 had a history of macular hole repair one month after RD repair. In 10 eyes with longer than 12-month follow up, VA significantly increased between 12-month and 24-month visit with no interventions that may increase the vision such as cataract extraction or YAG capsulotomy. Of 8 eyes with longer than 24-month follow-up, 7 eyes remained stable whereas VA decreased secondary to pigmentary changes in 1 eye after 24-month. The final VA significantly correlated with initial VA but not with the age, DS, the number of RD repairs (r=0.379, p=0.046, Pearson's correlation). In multivariate linear regression analysis with a backward approach, CME and initial VA were the statistically significant independent factors in a model of age, DS, initial VA, number of RD repairs, extent of RD, the occurence of CME and ERM as independent factors and the final VA as the dependent factor (Table 3).

Complications

The most common complications were ERM and increased intraocular pressure. It was controlled by topical anti-glaucomatous medications in all patients. CME was associated with ERM in 3 of 7 eyes. The additional surgeries were cataract extraction in 7 eyes (out of 6 cataracts and 8 clear lenses), membrane peeling in 6 eyes and macular hole repair in 1 eye. Table 4 shows the postoperative complications throughout the follow-up.

DISCUSSION

In this study, the final VA in patients with DS ≤ 7 days was not significantly different from the patients with longer DS.

Eyes with an extent of RD of 2 or less quadrants were more likely to have a better final VA compared to eyes with larger RD. Initial VA and CME were the predictors of final visual outcome. Visual recovery continued to improve at least up to 24 months following RD repair in eyes with macula off RD. One third of the patients with a poor final VA failed to show any obvious lesion on OCT for decreased vision at the final visit.

The duration of macular detachment and its association with the final visual outcome has been an interest for the investigators for many years. The hypothesis for this association is that the longer the photoreceptors separate from retinal pigment epithelium which provides the metabolic and nutritional support, the more they lose their vitality and functionality and expose to alterations in the neurotransmitters. Experimental studies showed that RD induces rapid, localized alterations in the glutamatergic system of the neural retina which could contribute to excitotoxicity and to the initiation of structural alterations and changes in gene expression.[8]

Liu et al., retrospectively analyzed the functional results after SB surgery in 96 macula off RD patients regarding DS and found that the final VA was significantly better in patients with DS ≤ 7 days compared to that in patients with DS>7 days. VA of 0.4 (Snellen) or more was achieved in 68% in the subacute duration (4-7 days) compared to 52% in the prolonged duration (>7 days).[3] In another study including 202 macula off eyes, Diederen et al.,[9] described a rapid worsening of VA when DS exceeds 6 days. Final VA ≥ 20/40 was achieved in 58.5% of eyes repaired in 10 days, 32.1% of patients in the delayed group and 0% of patients in the late group. Hassan et al. also reported that final VA ≥ 20/40 was seen in 71% of the patients with DS ≤ 10 days and 27% of the patients with DS>10 days.[10]

Salicone et al.,[6] stated that the duration of macular detachment was not of prognostic value up to 30 days in their study including 457 macula off RD eyes. Doyle et al.,[11] reported 7 cases with longer than 10 weeks of macular detachment with 6/12 or better visual outcome. Five of these seven patients had 6/36 or better VA preoperatively, which suggests preoperative VA, rather than DS, as a predictor for the visual outcome.

Similarly, in the study of Lecleire et al.,[5] preoperative VA was the only preoperative clinical variable that significantly correlated with the final VA, which is in concordance with our findings. In our study, the final VA was not significantly different in eyes with DS shorter than 7 days compared with eyes with longer DS. Height of macular detachment was reported to be a significant factor on the visual outcome of the patients with macula off RD.[4] It may even be a confounding factor when the effect of DS on visual outcome is being considered, such as in patients with a prolonged DS but shallow macular detachment and good final VA.[11] This condition may explain the incompatible findings between the studies regarding the effect of DS on visual outcome, however since we do not have macular height measurements at presentation, we can not comment truly on this subject.

Macular SRF has been shown to be a reason of poor vision after surgery in patients with macula off RD.[12-14] In a prospective study including 38 macula off eyes, OCT showed SRF in 94% of the eyes at 1-month, 72% at 3-month, 55% at 6-month, 17% at 12-month and none at 24-month follow-up.[12] Another OCT study demonstrated that, in a group of 12 patients who underwent episcleral surgery for macula off RD, the ratio of SRF was 66% at one-month, 41% at 3-month and 33% at 6-month follow-up.[13] The authors suggested that the absorbance of the residual fluid may be slower at the subfoveal level due to lower effectiveness of the RPE pump-effect in fovea. SRF was found to be associated with a worse visual prognosis in patients with macula off RD, however the effect of persistent SRF on VA was only small and temporary.[12] In another study, the authors reported SRF in 50% of the patients and VA was not significantly different in eyes with or without SRF at 3, 6, 9 and 12th months after surgery. [15] In our study, 6 eyes had SRF during the follow-up period and none of them had SRF detectable on OCT at their final visit which was at least 6 month after surgery.

ERM and CME are well-known complications following RD repair. The ratio of CME after RD repair changes between 4-12%.[1,2,16-18] In our study, CME was detected in 25% of the eyes throughout the follow-up and existence of CME at the final visit was found to be a significant independent factor for the final VA. ERM secondary to RD repair was recorded as 13-59% in the previous studies.[1,2,16-19] In our study, ERM was found in 39.2% of the eyes, however, it was not associated with poor vision. Similarly, Delolme et al.,[17] reported that the ratio of ERM were not significantly different between the good VA group and the poor VA group in the macula off patients. In a recent study, RRD patients were randomized either for oral prednisolone or for placebo following RD repair.[20] The occurrence of cellophane membranes was significantly lower in the steroid group versus placebo group at 1, 3 and 6-month follow-up, however, the visual outcome was not significantly different in two groups. These data suggest that ERM does not have a major effect on visual outcome although it is a common postoperative finding in RD patients.

In our study, visual recovery continued to improve at least up to 24 months following RD repair. Recent studies about the OCT findings after RD repair for macula off RD also give supportive information about the visual recovery after surgery. Shimoda et al.,[21] showed that foveal IS/OS line, which significantly correlated with VA, recovered gradually after surgery within 6 months. Similarly, Wakabayashi et al.,[16] reported a significant correlation between the final VA and IS/OS disruption and showed restoration of IS/OS junction in 7 of 11 eyes during the follow-up period but this restoration was seen only in eyes with an intact ELM. This result may explain the gradual improvement of VA over time in eyes with macula off RD.

In conclusion, visual outcome did not significantly differ according to DS up to one month and visual recovery can be observed up to 24 months after RD repair in patients with macula off RD. Initial VA and CME were the predictors of final VA and although frequently seen, ERM was not significantly associated with poor vision in this group of patients.

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