Original Article

# The Effect of Internal Limiting Membrane Peeling on Anatomical and Visual Outcomes in Patients with Macula-Off Retinal Detachment

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## Abstract

**Objectives:** This study aimed to evaluate the anatomical and visual outcomes of internal limiting membrane (ILM) peeling in patients with macula-involving ("macula-off") retinal detachment treated with silicone oil endotamponade.

**Materials and Methods:** The study included 19 eyes of 19 patients (Group 1, ILM peeled) and 33 eyes of 32 patients (Group 2, ILM not peeled) who underwent surgery for macula-off retinal detachment at Ege University Department of Ophthalmology. All patients underwent detailed ophthalmological examination and macular optical coherence tomography preoperatively, at postoperative 1 month, and 1 month after silicone removal.

**Results:** The mean age was 60.47±9.9 years in Group 1 and 57.56±10.63 years in Group 2. The average follow-up duration was 9.13±5.29 months. Preoperative visual acuity was 1.6±1.3 logarithm of the minimum angle of resolution (logMAR) in Group 1 and 1.1±0.8 logMAR in Group 2. At postoperative 1 month, visual acuity was 0.8±0.7 logMAR in Group 1 and 0.7±0.7 logMAR in Group 2 (p=0.1). At 1 month postoperatively, epiretinal membrane (ERM) development was not observed in Group 1, while 9 eyes in Group 2 developed ERM. Visual acuity after silicone removal was similar in both groups (p=0.2). Central foveal thickness (μm) and macular volumes ($mm^3$) were comparable in both groups (p>0.05). Three eyes in Group 2 that developed ERM underwent surgery and their visual acuity improved.

**Conclusion:** ILM peeling during vitreoretinal surgery in cases of macula-off retinal detachment may be effective in preventing ERM formation, though it does not result in significant visual improvement. Further studies with longer follow-up and larger patient cohorts are needed.

**Keywords:** Retinal detachment, epiretinal membrane, internal limiting membrane

## Introduction

Although retinal detachment was a cause of permanent blindness in the past, the success rate with surgical treatment is now up to 95%. In contrast to anatomical success, the rate of visual recovery tends to be lower.[1] Among the causes of visual impairment after vitrectomy surgery for rhegmatogenous retinal detachment (RRD), the formation of an epiretinal membrane (ERM) over the macula is one of the most common complications.[1,2] This complication occurs more frequently in chronic and macula-involving ("macula-off") retinal detachments.[1] These membranes are significant enough to require repeat ERM surgery in approximately one-third of patients.[1,3] Internal limiting membrane (ILM) peeling is a technique routinely practiced during surgery for macular pathologies.[4,5] Common indications for ILM peeling include various tractional vitreoretinal disorders such as macular hole, macular puckers, and ERM.[4,5] One study showed that the posterior vitreous cortex, cellular component, and extracellular matrix were completely removed in ILM-peeled eyes.[6] The aim of this study was to evaluate the effect of ILM peeling on anatomical and visual outcomes in patients who underwent surgical repair with silicone endotamponade for macula-off retinal detachment.

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## Materials and Methods

The study included 19 eyes of 19 patients (Group 1, ILM peeled) and 33 eyes of 32 patients (Group 2, ILM not peeled) who underwent surgery for macula-off retinal detachment at Ege University Ophthalmology Department between 2021 and 2023. All patients underwent a detailed ophthalmological examination (best corrected visual acuity [BCVA], intraocular pressure measurement, and fundus examination) and postoperative macular optical coherence tomography (mOCT) preoperatively, at postoperative 1 month, and at 1 month after silicone removal. Macular volume, subfoveal thickness, foveal contour, and inner segment/outer segment (IS/OS) junction/ellipsoid zone defect were evaluated from the mOCT scans. Inclusion criteria were having macula-off RRD and no additional macular pathology (myopic maculopathy, age-related macular degeneration, macular hole), uveitis, retinal vascular diseases, or optic neuropathy. Exclusion criteria were a history of intraocular surgery (including cataract surgery) and the presence of media opacity that would interfere with OCT evaluation.

In both groups, standard phacoemulsification with intraocular lens implantation and 25-gauge pars plana vitrectomy were performed by the same vitreoretinal surgeon. In Group 2, the ILM was not peeled and the surgery was concluded by administering silicone oil (Densiron XTRA; Fluoron, Neu Ulm, Germany). In Group 1, the ILM was visualized using ILM-BLUE (DORC, Zuidland, The Netherlands) and an area of approximately 2 disc diameters was peeled. Silicone oil was administered at the end of the surgery.

The patients were examined on the first postoperative day and then around postoperative 1 week, 1 month, 3 months, and 6 months. At each follow-up visit, a complete ocular examination was performed, including visual acuity examination (using a Snellen chart), anterior segment examination, intraocular pressure measurement, posterior segment evaluation, assessment for any complications, and mOCT imaging.

Ethical approval for this study was obtained from the Ethics Committee for Medical Research of Ege University (application no: 2023-1781, decision no: 23-12.1T/18, date: 28.12.2023). As the study was retrospective, informed consent was not required.

### Statistical Analysis

IBM SPSS Statistics version 25 (IBM Corp, Armonk, NY, USA) was used to analyze the data. Snellen visual acuity measurements were converted to logarithm of the minimum angle of resolution (logMAR) for statistical analysis. Percent frequencies were used to present qualitative variables and the mean and standard deviation (SD) were calculated for quantitative variables. Intergroup comparisons were made with chi-square tests for demographic data and t-tests for quantitative variables, with $p \leq 0.05$ considered statistically significant.

## Results

The mean age of the patients was 60.47±9.9 years (range, 31-74 years) in Group 1 and 57.56±10.63 years (range, 29-82 years) in Group 2 (p=0.394). In terms of gender distribution, there were 16 male and 3 female patients in Group 1 and 20 male and 12 female patients in Group 2 (p=0.15) (Table 1). The mean follow-up period was 9.13±5.29 months (range, 4-20 months). The mean time from retinal detachment to surgery was 15.6±25.96 days (range, 1-180 days). Preoperative BCVA was 1.6±1.3 logMAR (range, 3-1.3 logMAR) in Group 1 and 1.1±0.8 logMAR (range, 3-1 logMAR) in Group 2 (p=0.275) (Table 2). At postoperative 1 month, BCVA was 0.8±0.7 logMAR (range, 2.7-0.3 logMAR) in Group 1 and 0.7±0.7 logMAR (range, 3-0.2 logMAR) in Group 2 (p=0.1). The mean macular volume at postoperative 1 month was 9.12±2.18 $mm^3$ (range, 6.64-16.4 $mm^3$) in Group 1 and 9.14±1.16 $mm^3$ (range, 5.8-11.33 $mm^3$) in Group 2 (p=0.9), while the mean central foveal thickness was 349±136.8 µm (range, 203-823 µm) in Group 1 and 309.26±81.06 µm (range, 150-511 µm) in Group 2 (p=0.2). At postoperative 1 month, ERM was not observed in any of the eyes in Group 1 but was observed in 9 eyes (27.3%) in Group 2 (Table 3). After silicone removal, BCVA was 0.6±0.8 logMAR (range, 2.7-0 logMAR) in Group 1 and 0.6±0.6 logMAR (range, 2.7-0.1 logMAR) in Group 2 (p=0.2). The mean macular volume was 8.9±1.53 $mm^3$ (range, 7.11-12.87 $mm^3$) in Group 1 and 8.9±1.51 $mm^3$ (range, 4.88-13.28 $mm^3$) in Group 2 (p=0.9). The mean central foveal thickness was 334.2±126.7 µm (range, 173-600 µm) in Group 1 and 321.36±71.01 µm (range, 228-563 µm) in Group 2 (p=0.7). There were still no eyes in Group 1 with ERM, whereas ERM development was noted in 23 eyes (69.7%) in Group 2 (Table 4). Three of the eyes that developed ERM underwent surgery and showed an improvement in visual acuity. Intraretinal cysts were observed in 3 patients in Group 2 at postoperative

**Table 1. Demographic data**

| | Group 1 (n=19 patients) | Group 2 (n=32 patients) | p value |
|---|---|---|---|
| Mean age (years) | 60.47±9.9 (31-74) | 57.56±10.63 (29-82) | 0.394 |
| Gender distribution | 16 male, 3 female | 20 male, 12 female | 0.15 |

**Table 2. Preoperative findings**

| | Group 1 (n=19 eyes) | Group 2 (n=33 eyes) | p value |
|---|---|---|---|
| Visual acuity (logMAR) | 1.6±1.3 (3-1.3) | 1.1±0.8 (3-1) | 0.275 |
| ERM development | 0 (0%) | 9 (27.3%) | 0.015 |
| Time from RD to surgery (days) | 15.6±25.96 (1-180) | | |

logMAR: Logarithm of the minimum angle of resolution, ERM: Epiretinal membrane, RD: Retinal detachment

| Table 3. Postoperative findings at 1 month | | | |
|---|---|---|---|
| | **Group 1 (n=19 eyes)** | **Group 2 (n=33 eyes)** | **p value** |
| Visual acuity (logMAR) | 0.8±0.7 (2.7-0.3) | 0.7±0.7 (3-0.2) | 0.1 |
| ERM development | 0 (0%) | 9 (27.3%) | 0.015 |
| Mean macular volume ($mm^3$) | 9.12±2.18 (6.64-16.4) | 9.14±1.16 (5.8-11.33) | 0.9 |
| Mean central foveal thickness (µm) | 349±136.8 (203-823) | 309.26±81.06 (150-511) | 0.2 |
| logMAR: Logarithm of the minimum angle of resolution, ERM: Epiretinal membrane | | | |

| Table 4. Findings after silicone oil removal | | | |
|---|---|---|---|
| | **Group 1 (n=19 eyes)** | **Group 2 (n=33 eyes)** | **p value** |
| Visual acuity (logMAR) | 0.6±0.8 (2.7-0) | 0.6±0.6 (2.7-0.1) | 0.2 |
| ERM development | 0 (0%) | 23 (69.7%) | 0.01 |
| Mean macular volume ($mm^3$) | 8.9±1.53 (7.11-12.87) | 8.9±1.51 (4.88-13.28) | 0.9 |
| Mean central foveal thickness (µm) | 334.2±126.7 (173-600) | 321.36±71.01 (228-563) | 0.7 |
| logMAR: Logarithm of the minimum angle of resolution, ERM: Epiretinal membrane | | | |

1 month. Macular hole or lamellar hole was not observed in any patient during the follow-up. On OCT performed at postoperative 1 month, the foveal contour was intact in all patients and marked IS/OS defects were present in 7 eyes in Group 1 and 9 eyes in Group 2.

## Discussion

The ILM is the basal lamina of the inner retina and plays a crucial role in retinal development. In pathological states, however, the ILM tends to thicken with age and acts as a scaffold for cellular proliferation, leading to tractional forces on the retina and making ILM peeling an indispensable step in the surgical treatment of these disorders.[2] As macular ERM remains one of the most common causes of visual impairment after RRD vitrectomy surgery, ILM peeling is performed during RRD surgery in an effort to prevent postoperative ERM formation.[1,2] In this study, none of the patients who underwent ILM peeling (Group 1) developed ERM during the 6-month follow-up. In contrast, a substantial proportion (27.2%) of the group without ILM peeling (Group 2) developed ERM as assessed by mOCT within 6 months after surgery.

Martínez-Castillo et al.[7] noted a 9% incidence of ERM within 1 year after RRD surgery and reported that the mean BCVA decreased to 20/63 with ERM development and increased to 20/40 after surgical removal of ERMs. A recent meta-analysis examining ILM peeling and non-peeling in patients undergoing primary vitrectomy for RRD showed that the rate of ERM development was 29% when ILM peeling was not performed, similar to our results. Furthermore, although ILM peeling was effective in preventing postoperative ERM formation when compared to eyes without ILM peeling, visual change did not differ between the groups despite a positive anatomical outcome.[1] In contrast, Obata et al.[8] observed no significant difference in ERM formation between the ILM peeled and non-peeled groups in their study examining the effect of ILM peeling during surgery for macula-off RRD on postoperative functional and anatomical outcomes (3.5% and 7.8%, respectively, p=0.40).

In the last 10 years, the general recommendation in studies on this subject has been that in RRD patients, visual outcomes are not favorable with ILM peeling despite its effective reduction of ERM formation, and this procedure may be more suitable for complicated RRD.[8,9,10,11,12,13]

It is interesting that there is no relationship between the reduced rate of ERM formation with ILM peeling and the visual improvement seen across studies. Authors have proposed several possible factors, one or more of which might explain this. One of them is that eyes with macula-off RRD exhibit foveal microstructural changes, and preoperative photoreceptor junction deterioration may lead to greater vision loss postoperatively.[14]

### Study Limitations

In this study, a significant increase in visual acuity was observed in both groups. Despite the absence of ERM formation in the ILM peeling group, there was no significant increase in visual acuity compared to the other group. However, the short study duration, small number of patients, and retrospective nature of the study are important limitations, and long-term results have not yet been seen.

## Conclusion

In macula-off retinal detachments, ILM peeling during vitreoretinal surgery is effective in preventing ERM development. However, this benefit is not reflected in visual success. Studies with longer follow-up and larger patient groups are needed to determine long-term outcomes.

### Ethics

**Ethics Committee Approval:** Ethical approval for this study was obtained from the Ethics Committee for Medical Research of Ege University (application no: 2023-1781, decision no: 23-12.1T/18, date: 28.12.2023).

**Informed Consent:** Retrospective study.

**Declarations**

**Authorship Contributions**

Surgical and Medical Practices: C.D., F.A., Concept: C.D., Design: C.D., Data Collection or Processing: C.D., F.A., Analysis or Interpretation: D.B., C.D., F.A., Literature Search: D.B., C.D., Writing: D.B., C.D., F.A.

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