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Original Article

Effect of ILM Peeling on Anatomical and Visual Outcomes in Diabetic Tractional Retinal Detachment

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Abstract

Objectives: The objcetive is to compare the anatomic and functional outcomes of vitrectomy between internal limiting membrane (ILM) peeling and non-ILM peeling in diabetic tractional retinal detachment (TRD).

Methods: Twenty-three eyes with diabetic TRD with ILM peeling were compared with twenty-four eyes with non-ILM peeling. Best-corrected visual acuity (BCVA) was recorded at baseline and 3, 6, 9, 12 months, and end of follow-up. The mean retinal thickness across nine different regions that defined in the Early Treatment Diabetic Retinopathy Study (ETDRS) were obtained. The ETDRS grid was used to determine the extent of macular involvement.

Results: In the 1st month postoperatively, the mean BCVA of eyes with ILM peeling (1.08±0.63 LogMAR) was significantly better than eyes with ILM non-peeling (1.69±0.75 LogMAR, p=0.003). There was also a significant difference at 9 and 12 months between groups in BCVA, in favor of ILM peeling (p=0.012 and p=0.047, respectively). Seven patients (29.2%) developed epiretinal membrane (ERM), and one patient (4.1%) had ERM with the lamellar macular hole in the ILM non-peeling group, while only one patient developed ERM in ILM peeling group during the follow-up.

Conclusion: ILM removal may be considered in diabetic TRD surgery, as it can provide rapid visual recovery. Moreover, post-operative ERM formation was less frequent in ILM peeled eyes within 1 year after surgery.

Keywords: Epiretinal membrane, internal limiting membrane, pars plana vitrectomy, proliferative diabetic retinopathy, tractional retinal detachment

Introduction

Tractional retinal detachment (TRD) is an advanced form of proliferative diabetic retinopathy (PDR) that results from neovascular growth from existing retinal vasculature into the vitreomacular interface with accompanying fibrotic tissue and contractile elements (1). This contractile fibrous tissue generates anteroposterior and tangential traction on the fibrovascular complex and thinned ischemic retina. Excessive traction causes the fragile new vessels to bleed into the vitreous and/or pre-retinal space and leads to detachment of the retina (2).

The internal limiting membrane (ILM) is composed of the Müller cells footplates and provides a sort of scaffolding for

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cells such as myofibroblasts, fibrocytes, and retinal pigment epithelium (RPE) cells (3). This formation may lead to abnormal vitreomacular traction in time. Thus, ILM peeling has become an essential part of surgical management of macular holes, idiopathic epiretinal membrane (ERM), and chronic diabetic macular edema (4-6).

We aimed to analyze the anatomical and functional outcomes of ILM peeling and to compare those with patients who did not undergo ILM peeling in TRD with diabetic retinopathy.

Methods

The study was designed retrospectively, designed to include all consecutive eyes with TRD that had macular involvement and successful repair using 23-gauge (G) pars plana vitrectomy (PPV) between 2019 and 2021 and were followed in the retina for at least 12 months. A total of 163 eyes were initially evaluated. Of that total, those that had simultaneous cataract surgery (n=64, 39.2%) were eliminated to avoid bias. Furthermore, patients with combined rhegmatogenous and TRD (n=24, 14.7%) were not included in the study. We excluded 28 (17.1%) patients with other causes of proliferative vitreoretinal disease, high myopia (axial length >26 mm), and previous presence of glaucoma. In addition, those with hypertension and renal failure were excluded from the study.

After applying these criteria, 47 eyes with TRD were eligible to be a part of the study. A sample size of 18 in each group would be required to achieve an 80% testing power based on the results from our retrospective clinical and OCT study after diabetic vitrectomy for TRD (unpublished data), and based on the results of an earlier study on diabetic macular TRD (7). In the present study, the sample size was determined by doubling the calculated number to ensure a reliable outcome.

The morphological classification of PDR patients in the study group was based on Kroll's classification, as established in the literature (8,9). When the degree of retinal photocoagulation was evaluated in the patients, it was defined as "full PRP" if panretinal PRP was completed in all quadrants, or as "partial PRP" otherwise. None of the patients had uncontrolled hypertension or renal failure.

The study was approved by the Local Ethics Committee (number E-48670771-514.99-441) and followed the Declaration of Helsinki. Informed consent was obtained from each patient.

Best-corrected visual acuity (BCVA) was recorded at baseline at 3, 6, 9, and 12 months, as well as at end of follow-up and was converted to logMAR for statistical analysis. In addition, all demographic data and measured intraocular pressure at each visit were noted.

Surgery

Five days before surgery, 1.25mg/0.05ml intravitreal Bevacizumab (Avastin; Genentech, South San Francisco, CA, USA) was routinely administered. All eyes were operated on by same surgeon (O.A) using an identical surgical techniques until the ILM peeling stage. After general anesthesia or the sub-Tenon's local anesthesia with sedation, three-port 23G PPV was performed using the Alcon Constellation system (Alcon Laboratories, Inc., Fort Worth, TX, USA). All eyes underwent total vitrectomy. The ILM peeling decision was based on the following situations in both preoperative spectral domain optical coherence tomography (SD-OCT) image and perioperative macular appearance: a) significant macular wrinkling but no visible ERM, or b) retinal stiffness. Thus, we performed ILM peeling using Brilliant Blue dye by ILM forceps in the macula area. In cases of insignificant wrinkling and no visible proliferative vitreoretinopathy (PVR) membrane remnant, ILM peeling was not performed. To eliminate peripheral cortical vitreous remnants and anterior fibrovascular proliferation, which causes rebleeding and secondary proliferation, the vitreous base was shaved (360°), fibrovascular membrane dissection was performed in a bimanual fashion with chandelier light, and perfluorocarbon liquid (PFCL; Bio Decalin, Biotech Healthcare GmbH, Luzern, Switzerland) was injected into the vitreous cavity. Then endolaser was applied in pan-retinal photocoagulation (PRP) fashion, or in the case of four patients(8.5%) applied around the tear due to an iatrogenic tear in surgery; it did not cause any complications. After PFCL-air exchange, the eye was filled with a nonexpansile concentration of sulfur hexafluoride (SF6), perfluoropropane (C3F8), or silicone oil (SO), depending on the surgeon's decision. All sclerotomies were sutured. After surgery, topical antibiotics and anti-inflammatory agents were administered for 1 month.

When using SO as a tamponade, it was removed 4–6 months after surgery.

Imaging

All patient's images were obtained through a dilated pupil by the same senior technician using the spectral domain-optical coherence tomography (SD-OCT) (Heidelberg Engineering, Inc., Heidelberg, Germany (version 1.8.6.0), and the HRA/Spectralis Viewing Module (version 5.8.3.0). This version of the device with the updated software may increase diagnostic accuracy, enabler manual segmentation and automatic segmentation error to be effectively corrected, and improve on face image accuracy. The device's software analysis involved measuring the mean retinal thickness across nine different regions: the central circle (1 mm in diameter), an inner ring divided into four quadrants (3 mm in diameter with a central fovea), and an outer ring

that was further subdivided into four quadrants (6 mm in diameter and covers the inner circle and the fovea). We examined all patient images and performed manual correction as needed. The results of the measurements did not change. All the subfields defined by the Early Treatment Diabetic Retinal Study (ETDRS) were obtained from the manufacturer-supplied Spectralis software. The ETDRS grid, provided as an overlay tool in various imaging systems, was used to determine the extent of macular involvement. We defined macular tractional detachment as ≤6.0 mm perifoveal involvement relative to the outer circumference of the ETDRS grid on optical coherence tomography.

Statistical Analysis

Descriptive statistics were used to describe continuous variables (Mean, standard deviation, minimum, median, maximum). Chi-square test (or Fisher's exact test, where appropriate) was used to examine the relationship between categorical variables. The normality of data was analyzed by the Shapiro–Wilk test. The comparison of two independent and non-normally distributed variables was made with the Mann–Whitney U test. Multiple linear regression was used to analyze the association of two or more independent variables in predicting a dependent BCVA at 12 months in the study group. Kaplan–Meier and Cox regression analyses were performed as survival analyses for continuous parameters. Backward: Wald variable selection (Wald) method was used to obtain a meaningful model.

Analyses were performed using MedCalc Statistical Software version 12.7.7 (MedCalc Software BVBA, Ostend, Belgium; http://www.medcalc.org; 2013). The statistical significance level was determined as 0.05.

Results

Study Population

Forty-seven consecutive eyes from 47 patients that underwent 23G PPV for primary repair of diabetic TRD were included in this study. All eyes had macular involvement, and the traction detachment of the macula had been present for <6 months. The groups were well matched by their clinical features at baseline as shown in Table 1.

Patients were evaluated under two groups: "ILM peeling," meaning eyes with ILM peeling (n=23), and "ILM non-peeling," meaning eyes without ILM peeling (n=24) during the vitrectomy. According to Kroll's classification, (9) the stages C1–C4 were characterized by tractive retinal detachment involving the macula depending on the number of quadrants involved, seventeen (70.8%) of the patients in the ILM non-peeling group were stage C2 and the rest (n=7, 29.2%) were stage C3. In the ILM non-peeling group, 18 (78.3%) were stage C2, and the rest (n=5, 21.7%) were stage C3. Thus, there was no statically significant difference between groups (p=0.649).

BCVA and Intraocular Pressure

In the 1st month of the post-operative period, the mean BCVA (LogMAR) of eyes with ILM peeling (1.08±0.63) was significantly better than eyes with ILM non-peeling (1.69±0.75, p=0.003). Similarly, there was a statistically significant result at 9 and 12 months, with p=0.012 and p=0.047, respectively (Table 2). In the linear regression model created with backward variable selection, predictors of good visual outcome were ILM peeling and gas tamponed; additionally, the duration of Diabetes Mellitus, pre-operative BCVA, and lens status were not to be associated with BCVA at 12 months (Table 3). The final visual acuity was 0.67±0.34 LogMAR in the ILM peeling group and 1.11±0.85 LogMAR in the ILM non-peeling group (p=0.62). According to the World Health Organization (WHO), Snellen's visual acuity is equal to or better than 20/80 is classified as a mild category or no visual impairment (10). Based on the classification, we took 0.6 LogMAR as the cut-off value for visual acuity.

Table 4 shows the eyes in the study group with final visual acuity better and worse than 0.6 LogMAR. Furthermore, based on Kaplan–Meier analysis, the overall median final visual acuity was 1.0 LogMAR (95% CI: 0.714, 1.286). Therefore, according to this analysis, 50% of the patients for whom ILM peeling was performed, achieved a median probability BCVA (LogMAR) 1.0 by the end of the follow-up period.

Only five patients had transient ocular hypertension (those three in the ILM-peeling group, the other two in the ILM non-peeling group) in the post-operative 1st week. In the post-operative 1st month, the mean intraocular pressure (IOP) was 15.79±2.96 mmHg in the ILM non-peeling group and 16.91±3.96 mmHg was in the ILM peeling group (p=0.248). Neither glaucoma nor neovascular glaucoma developed in any patient during the follow-up period.

Macular Thickness

The mean central macular thickness CMT was 494.96±90.67 prior to the operation, 362±85.77 at 1 month, and 300.74±86.23 at 12 months in the study group (for each, p=0.000). Although the mean CMT was thinner in the ILM peeling group than in the ILM non-peeling group during the follow-up, this difference was not statistically significant (p>0.05). These results are summarized in Table 5.

The macular thickness values for all macular sectors (i.e., superior, inferior, nasal, and temporal) of the inner ring were 3 mm, and that of the outer ring was 6 mm, as shown in Table 6.

Table 1. Demographic and clinical data of study group

	ILM non-peeling (Mean±SD) Med. (Min.-Max.)	ILM peeling (Mean±SD) Med. (Min.-Max.)	p
Age (Years)	60.33±6.90	56.0±8.62	0.07¶
	61– (50–73)	57– (41–73)	
Gender (Female/Male) (n,%)	14 (58.3%)/10 (41.7%)	11 (47.8%)/12 (52.2%)	0.564
Laterality (Right/Left) (n,%)	14 (58.3%)/10 (41.7%)	12 (52.2%)/11 (47.8%)/	0.772
Duration of DM (Month)	16.08±4.38	14.78±5.04	0.235¶
	15.5– (9–24)	14– (8–25)	
HbA1c (%)	7.54±0.65	7.46±0.56	0.687*
	7.55 (6.5–8.8)	7.40 (6.7–8.5)	
Preop_BCVA(LogMAR)	2.06±0.96	1.81±0.95	0.072¶
	1.8– (0.52–3.1)	1.51– (0.4–3.1)	
Preop_IOP(mmHg)	15±2.21	14.78±1.98	0.730¶
	15– (11–19)	15– (11–19)	
Lens Status			
Phakic	18 (75.0%)	21 (91.3%)	0.245¶
Pseudophakia	6 (25.0%)	2 (8.7%)	
Preop_CMT(µm)	475.79±105.97	514.96±68.07	0.072¶
	438– (336–663)	512– (408–673)	
Presence of VH (n, %)			
No	12 (50.0%)	11 (47.8%)	1.000
Yes	12 (50.0%)	12 (52.2%)	
Presence of PRP (n, %)			
Partial	13 (54.1%)	12 (52.2%)	0.475¶
Full	11 (45.8%)	11 (47.8%)	
Duration of TRD	1.97±0.66	1.69±0.55	0.150¶
	2 (1–3)	2 (1–3)	
Tamponade			
SO (1000cSt)	8 (33.3%)	7 (30.4%)	1.000
SO (5000cSt)	6 (25.0%)	7 (30.4%)	
SF6	2 (8.3%)	2 (8.7%)	
C3F8	3 (12.5%)	2 (8.7%)	
Air	5 (20.8%)	5 (21.7%)	

Independent Sample T test*, Mann-Whitney U test¶, Fisher's Exact test, DM: Diabetes mellitus, Preop: Preoperative, BCVA: Best-corrected Visual Acuity, IOP: Intraocular Pressure, CMT: Central Macular Thickness, VH: Vitreous Hemorrage, PRP: Panretinal photocoaqualation, TRD: Tractional retinal detachment, SO: Silicone oil, SF6: Sulfur hexafluoride, C3F8: Perfluoropropane.

Furthermore, statistically significant parameters according to ILM peeling, i.e., the temporal sector in the inner and outer ring at 12 months post-operative, were included in the multivariate Cox regression analysis (Survival time: Final Visual Acuity, Event: ILM peeling). We found that only the variable thickness of the outer temporal sector was significantly associated with the final vision acuity. (p=0.039) (Hazard Ratio: 0.996, 95% CI: 0.991, 1.000).

Table 2. Comparison of the Best corrected Visual Acuity between the ILM peeling group and the ILM non-peeling group

Post-operative	ILM-non peeling (Mean±SD, LogMAR) (Range)	ILM peeling (Mean±SD, LogMAR) (Range)	p
1M	1.69±0.75 (0.52–3.1)	1.08±0.63 (0.3–3.1)	0.003
3M	1.52±0.74 (0.4–3.1)	1.15±0.67 (0.3–3.1)	0.07
6M	1.51±0.73 (0.4–3.1)	1.10±0.48 (0.3–1.8)	0.074
9M	1.49±0.85 (0.52–3.1)	0.91±0.43 (0.3–1.8)	0.012
12M	1.31±0.80 (0.4–3.1)	0.87±0.43 (0.2–1.8)	0.047

Mann-Whitney U test, M: Month.

Table 3. Multiple linear regression analysis of 12th Months BVCA

	Adjusted	p	F			
Model	0.184	0.147	0.011	4.957		
	Unstandardized	**Standard Error**	**Standardized**	**t**	**p**	**VIF**
Constant	1.463	0.149		9.803	<0.001	
ILM: Peeling	-0.451	0.182	-0.336	-2.470	0.017	1.001
Tamponade: Gas	-0.375	0.186	-0.275	-2.016	0.050	1.001

Dependent: Logmar 12 month Independent: Duration of DM (Month), Preop BCVA (LogMAR), Lens Status, ILM, Tamponade In the model constructed with backward variable selection, there is no multicollinearity problem since the VIF value is <10. The model is statistically significant (p=0.011).

Table 4. Comparison of patient's variables according to final visual acuity when taking 0.6LogMAR as a cut-off value

	BCVA≤0.6LogMAR		BCVA>0.6LogMAR		p
Duration of DM (Month)					
(Mean±SD)	15.17±4.09		15.62±5.12		0.9651
Med. (Min.-Max.)	15– (10–21)		14– (8–25)		
Preop BCVA(LogMAR)					
(Mean±SD)	1.68±0.88		2.09±0.97		
Med. (Min.-Max.)	1.3– (0.4–3.1)		1.8– (0.52–3.1)		0.1521
Lens Status (n, %)					
Phakic	17	94.4%	22	75.9%	0.130
Pseudophakia	1	5.6%	7	24.1%	
ILM (n, %)					
Non-Peeling	8	44.4%	16	55.2%	0.556
Peeling	10	55.6%	13	44.8%	
Tamponade (n, %)					
SO (1000cst+5000cst)	9	50%	19	65.5%	0.297
Gas (Air+SF6+C3F8)	9	50%	10	34.5%	

Mann-Whitney U test1, Fisher's Exact test, DM: Diabetes mellitus, Preop: Preoperative, BCVA: Best-corrected visual acuity, ILM: Inter limiting membrane, SO: Silicone oil, SF6: Sulfur hexafluoride, C3F8: Perfluoropropane.

Table 5. Comparison of central macular thickness between the ILM peeling group and the ILM non-peeling group (Mean±SD, µm)

Post-operative	ILM-non peeling (Mean±SD, micron) (Range)	ILM peeling (Mean±SD, micron) (Range)	p
1M	384.38±124.65	372.65±100.41	0.790
	366– (196–652)	344– (221–632)	
3M	368.04±126.85	358.04±105.68	0.650
	344– (198–674)	342– (215–569)	
6M	386.71±146.74	336.13±110.65	0.225
	377.5– (187–729)	321– (215–674)	
9M	339.88±113.12	312.65±94.92	0.238
	323– (184–589)	281– (204–504)	
12M	312.5±102.2	288.83±65.74	0.386
	302.5– (194–561)	280– (208–467)	

Mann-Whitney U test, M: Month.

Table 6. Comparison of macular thickness according to the ETDRS grid between the ILM peeling group and the ILM non-peeling group (Mean±SD, µm)

Month	Nasal (3 mm)	Superior (3 mm)	Temporal (3 mm)	Inferıor (3 mm)	Nasal (6 mm)	Superior (6 mm)	Temporal (6 mm)	Inferıor (6 mm)
1								
ILM-NP	426.58±88.59	405.08±79.81	402.02±87.81	416.46±70.21	429.08±87.54	404.46±88.23	372.63±73.04	388.38±53.86
ILM-P	416.74±69.62	410.04±80.52	382.04±79.35	395.22±69.47	429.96±64.44	396.0±63.11	358.39±72.55	361.74±58.6
p	0.865	0.815	0.431	0.317	0.890	0.915	0.322	0.053
3								
ILM-NP	422.58±109.36	397.46±98.64	383.63±96.39	392.29±82.90	423.0±98.22	377.88±103.7	348.67±73.31	359.92±73.81
ILM-P	400.78±78.13	385.87±68.40	374.04±114.8	398.08±96.0	404.09±67.26	392.78±83.40	345.17±63.30	359.87±77.48
p	0.625	0.725	0.476	0.655	0.509	0.287	0.694	0.975
6								
ILM-NP	430.21±113.89	399.33±104.6	389.96±105.8	401±111.04	388.13±85.91	374.04±88.45	338.17±87.49	351.42±65.33
ILM-P	396.96±82.14	398.3±99.10	365.13±92.03	366.39±73.4	407.57±70.03	380.74±78.83	332.04±69.50	330.22±51.31
p	0.401	0.865	0.551	0.437	0.246	0.566	0.798	0.238
9								
ILM-NP	389.29±95.28	386.83±105.6	360.67±96.57	370.21±96.76	392.46±78.26	366.96±84.44	337.71±74.19	335.88±58.13
ILM-P	361.87±86.28	355.91±65.43	344.0±78.24	350.74±69.23	375.96±75.10	359.70±66.44	332.43±64.08	331.22±53.58
p	0.463	0.766	0.798	0.655	0.496	0.624	0.932	0.238
12								
ILM-NP	376.83±76.18	372.71±99.13	364.01±92.90	371.0±78.29	387.79±57.8	345.54±60.91	341.33±80.26	333.29±62.46
ILM-P	353.35±102.95	359.0±85.46	324.61±96.42	335.87±82.56	363.87±85.12	342.96±57.73	319.91±104.36	314.96±55.18
p	0.259	0.686	0.035	0.066	0.077	0.774	0.045	0.183

Mann-Whitney U test. Abb: ILM; Internal Limiting Membrane, NP; Non-Peeling, P; Peeling.

Post-operative Complications

Although absorption of subretinal fluid took up to 10 months postoperatively in 3 of 47 patients in the study, anatomic success was 100% for all patients at the end of follow-up. On average, subretinal fluid was removed in an average of 5.13±0.87 months among the 28 (59.6%) patients who used SO.

Eight patients (33.3%) had cystoid macular edema in the ILM non-peeling group. Of these eight patients, CME was present on OCT images at month 3 in four patients, month 6 in three patients, and the month 9 in one. On the other hand, only one patient (4.2%) has CME in the ILM peeling group during the follow-up period. When macular edema was observed in the post-operative period, intravitreal anti-VEGF (vascular endotgelial growth factor) therapy was administered to patients as needed.

Moreover, seven eyes in the ILM non-peeling group had ERM, three of which had clinically significant ERM that produced metamorphopsia and decreased visual acuity. Therefore, these three patients underwent a second vitrectomy. While the mean BCVA values were 1.2±0.17 logMAR before surgery in eyes with ERM, it increased to 0.50±0.2 logMAR in the 3rd month postoperatively (p=0.048). On the other hand, one patient (4.1%) had a lamellar hole with ERM in the ILM peeling group on the OCT image and did not progress during the follow-up.

In addition, at the end of the 1-year follow-up, none of the phakic patients required cataract surgery, but five had insignificant lens opacities. In addition, no one in the study group had observed no endophthalmitis, vitreous cavity hemorrhage, or choroidal detachment during the follow-up period.

Discussion

Our study showed that visual acuity improved after a vitrectomy in patients with TRD caused by diabetic retinopathy. This increase was more prominent in the group that underwent ILM peeling at the 1st, 9th, and 12th months compared to those who did not undergo ILM peeling. Although the ILM peeling group experienced slightly better vision, there was no statistically significant difference between the two groups during the follow-up period. We also found that the temporal portion of the 6 mm outer ring centered on the fovea relative to the ETDRS grid was statistically significantly associated with final visual acuity. This was unexpected because such a finding was not common in the results of similar studies.

TRD is a severe, sight-threatening stage of PDR. Although its treatment is challenging, high success rates can be achieved by developing small-gauge vitrectomy systems (11,12). In the literature, anatomical success in diabetic tractional retinopathies performed with 23G PPV is reported as 90%–100% (2,13,14). In the current study group, anatomical success was achieved in all eyes, in accordance with the literature.

Although there is currently no definitive judgment about pre-operative PRP, the vision of patients who underwent PRP has been reported remained relatively stable without severe inflammation in the post-operative period (15,16). Our study might support these findings since we did not encounter vision loss or fibrin reaction after PPV, as patients underwent full or partial pan-retinal laser photocoagulation before surgery.

In general, tamponades used for TRD surgery, namely SO, air, or C3F8, demonstrated a similarly successful effect. Yorston et al. (17) reported that a long-acting tamponade such as C3F8 or SO was associated with worse visual prognoses. They hypothesized that this outcome was due to the surgery preferred in complex cases with limited vision prospects rather than the direct effect of tamponades. Conversely, Tao et al. (18) did not use tamponades in their study involving 168 eyes with TRD, in which they followed their patients for a long time. They achieved 98.4% anatomical success of and stated that tamponade is unnecessary if there is no retinal tear. In our study, there was no difference in tamponade use between the groups with and without ILM peeling. While SO was preferred, air was used as the second tamponade. According to linear regression analyses, gas tamponade was associated with better visual acuity in the 12th month. Nonetheless, we did not detect any correlation between the tamponades and the final visual acuity at approximately 30 months.

ILM peeling is based on the benefit obtained by the removing the scaffold used by astrocytes and myofibroblasts to proliferate on the retinal surface that leads to secondary ERM formation and by the elimination of all tractional forces at the vitreoretinal interface (6). The efficacy of ILM removal in enhancing post-operative BCVA after vitrectomy for TRD is still unclear. Some studies have reported better vision in TRD in those undergoing ILM peeling, (19) while others reported no efficacy of ILM peeling on post-surgical visual acuity (20). Jung et al. (21) stated that ILM peeling should be a part of TRD surgery with macular involvement due to accelerated subfoveal fluid absorption and macular absorption reattachment. They speculated that the tractional membrane that leads to the rigidity of the retina would not fully recover after removing the fibrovascular membrane. Therefore, they suggested in their study that removing the rigid and contracted ILM over the detached retina would restore its elasticity, facilitate its reattachment, and improve BCVA.

Regarding the best-corrected visual acuities, we found that the ILM peeling group was better than the ILM non-peeling group 1 month post-surgery. In vitrectomy, ILM peeling may provide rapid anatomic and functional recovery, as it completely cleans the remaining hyaloid membrane and prevents retinal rigidity. However, there was no statistically

significant difference difference in visual acuity between ILM peeling and non-peeling groups at months 3 and 6. Nevertheless, the ILM peeling illustrated better BCVA at months 9 and 12 compared to the ILM non-peeling group. This finding might be attributed to a lower risk of ERM formation and macular edema in the ILM peeling group. On the other hand, the statistical difference at 12 months did not persist over the 2 years of follow-up. This result may relate to the status of metabolic control in diabetic patients.

In addition, when we evaluated eyes with Snellen acuity better than 20/80, which is the near-normal distance vision criterion according to WHO criteria, we found that 55.4% were in the ILM peeling group. Regarding anatomical improvement, there was a significant improvement in the entire study group compared to the pre-operative CMT group. The diminution of macular thickness revealed no statistical difference between the ILM peeling and non-peeling eyes. In contrast, the rate of subfoveal fluid reabsorption, ellipsoid zone recovery, and disappearance of cystic formation was superior in the ILM peeling group.

Interestingly, we found that the temporal portion of the 6 mm outer ring centered on the fovea relative to the ETDRS grid was significantly associated with final visual acuity. Eccentric fixation may develop in eyes with DME (22,23). According to our data, the negative effect on visual acuity with increased temporal region thickness may relate to the eccentric fixation developed in these patients. Although we used the ETDRS Macular Map, a clinically standard clinical scanning tool to measure macular thickness, this measurement does not always allow us to obtain detailed OCT information (e.g., thickening, schisis, and subretinal fluid caused by greater thickness that may affect vision differently). Therefore, in addition to the OCT map, subgroup analysis may be helpful for clinicians.

Most studies agree that ILM peeling leads to less ERM formation than non-peeling in TRD surgery (16,17). Similar to previous studies, ERM formation was seen in 29.2% (seven patients) of eyes without ILM peeling. Of these patients, three (42.8%) underwent a second vitrectomy due to metamorphopsia and low vision. However, no significant post-operative ERM formation was detected in eyes with ILM peeling. Thus, patients' second surgery requirement can be minimized.

One of the main limitations of the current study was its retrospective design. Another was the absence of TRD due to a particular classification, which included both the extent of involvement and the presence of retinal ischemia. However, the presence of macular involvement and similar morphological classifications in all patients can be considered homogeneous in the study group. Another limitation was the relatively small sample size. Hence, we suggest that further randomized prospective studies with more cases might help validate the effectiveness of ILM peeling in TRD with macular involvement.

Conclusion

In this comparative study, ERM formation and macular edema were observed less frequently in the ILM peeling group during the follow-up period. In addition, rapid improvement was achieved in terms of visual acuity. Therefore, ILM peeling during vitrectomy in eyes with TRD due to diabetes may be an additional step in increasing surgical success.

Disclosures

Ethics Committee Approval: The study was approved by the Local Ethics Committee (number E-48670771-514.99-441) and followed the Declaration of Helsinki. Informed consent was obtained from each patient.

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

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