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ORIGINAL ARTICLE

Vitrectomy With Internal Limiting Membrane Peeling in the Management of Primary Rhegmatogenous Retinal Detachment

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Abstract

Aim of the work: **To assess the role of internal limiting membrane (ILM) peeling with vitrectomy for primary rhegmatogenous retinal detachment and detection of associated macular changes.**

Method: **50 patients with a primary rhegmatogenous retinal detachment that match the inclusion criteria were studied. Patients were subgrouped into two groups; the first group underwent ppv without ILM peeling and the second group underwent ILM peeling with vitrectomy. The main outcomes recorded were best-corrected visual acuity (BCVA) and the occurrence of ERM on SD-OCT.**

Results: **There were 25 eyes in each group. The patients in the second group did not develop ERM at the end of the follow-up period compared to the presence of 28% in the first group who developed ERM. There was no statistical difference in mean BCVA between both groups.**

Keywords: Rhegmatogenous retinal detachment, The internal limiting membrane, Vitrectomy

1. Introduction

Rhegmatogenous retinal detachment (RRD) is known to be a separation of the neural layer of the retina from the pigmented epithelial layer due to leakage of the vitreous through a tear in the neuroretina into the subretinal space.[1] The internal limiting membrane (ILM) is known to be a transparent layer that surrounds the retina and the vitreous body. Its main components are Müller cells, collagen fibers, glycosaminoglycans, laminin, and fibronectin, forming what's called the cuticular layer.[2] For retinal detachment surgeries, there are many procedures, such as pneumatic retinopexy, scleral buckling (SB), pars plana vitrectomy (PPV), and a combination of both (PPV/SB).[3] The presence of new machines in vitrectomy increased the rate of treated cases.[4] The formation of a macular pucker layer after pars plana vitrectomy (PPV) in RRD repair occurs in about 12.8% of cases. Overall the benefit of the removal of macular epiretinal membranes (ERM) in repeated surgeries is 4.3% and mainly in the visual acuity improvement.[4] ILM peeling causes ERM prevention in a significant way ($P < 0.001$). While there is no significant difference regarding the final best corrected visual acuity (BCVA) without ILM peeling.[5] Swelling of the arcuate retinal nerve fiber layer (SANFL) was observed early after ILM peeling, which improved within a few months. If SANFL caused defect of dissociated optic nerve fiber layer as dimples in (OCT) and appeared faintly on fundus.[5] Our study aimed to assess the role of peeling of the internal limiting membrane with vitrectomy in case of management primary rhegmatogenous retinal detachment and detection of associated macular changes.

2. Patients and methods

After ethical committee approval and written informed consents, this study was carried out from February 2020 to August 2022 on 50 eyes of fifty

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patients who came to the outpatient clinic of the ophthalmology department, Al- Azhar university hospitals with retinal detachment and scheduled for pars plana vitrectomy with silicone oil tamponade. Patient Selection: We included patients diagnosed with Primary rhegmatogenous retinal detachment. Patient with pseudophakic retinal detachment. A patient presented with aphakic retinal detachment. Patient with phakic retinal detachment not suitable for pneumatic retinopexy. Exclusion criteria: Patient with diabetic retinopathy, previous ERM, history of trauma or uveitis, proliferative vitreoretinopathy more than grade B, and recurrent retinal detachment. The treatment was done by Pars plana vitrectomy and cases were randomly divided into 2 groups: Group I of 25 eyes underwent vitrectomy without peeling of ILM. Group II of 25 eyes underwent vitrectomy and peeling of ILM. Data fields gathered compromise: The demographic distribution of the included patients as age and sex.

Pre-operative examination: All patients examined complete ophthalmological examination by history taking and ocular examination in the form of best corrected visual acuity (BCVA) using a LogMar chart, intraocular pressure measurement by tonometer, and finally biomicroscopic fundus examination. The patients also underwent B scan ultrasonography in all eyes in which visualization of the fundus was not attained and (OCT) in cases of macula-on RD. Finally, Data about the distribution and configuration of the retinal detachment and involvement of the macula were recorded.

Surgical Intervention: By using local anesthesia. (lignocaine 1%: bupivacaine 0.5% 1:1). Dilatation of the pupil was achieved by cyclopentolate 1%+ phenylephrine 2.5%+diclofenac 0.1%. Periocular skin was sterilized with 10% povidone-iodine painting. Eyes were draped using plastic incision drapes. A lid speculum was inserted. The conjunctival sac was sterilized with 5% povidone-iodine. Three 23-gauge one-step valved trocars were inserted. Phacoemulsification with an acrylic hydrophobic intraocular lens in the bag implantation after occlusion of cannulas by plugs. A binocular indirect ophthalmo-microscope (BIOM) was used for visualization. With the aid of D.O.R.C vitrectomy machine, corevitrectomy was done then PVD was created. Injection of triamcinolone acetonide gently into the mid-vitreous cavity was done to ensure the detachment of the posterior hyaloid. We drained the subretinal fluid (SRF) by existing retinal breaks or through peripheral retinotopic if needed. In Group B eyes, the infusion was stopped and Brilliant Blue G dye 0.025% was instilled in the macula for 30 s Then the infusion was opened after a few seconds and the dye was aspirated. The pinch and peel were preferred for peeling. We sometimes used perfluorocarbon liquid (PFO) to act as a counter-traction during the process of peeling. Vitreous base shaving was done with scleral indentation. We made endolaser photocoagulation at 360° and for all retinal breaks and retinotomies with sparing of the horizontal meridian. PFCL/Air exchange was done then we injected silicone oil and finally, we removed the trocars. The sutures were taken only in case of leakage. Postoperatively we followed up with the patients by complete ophthalmological examination in the 1st month, 3rd month, and 6th month. The main included examinations were best-corrected visual acuity, anterior segment examination, IOP measurement, and fundus examination. OCT assessment was done at the 3rd month and 6th month postoperatively.

The primary outcome measures included anatomical outcomes assessed by the detection of any morphological changes by SD-OCT and the presence of ERM after vitrectomy with/without ILM peeling. The secondary outcome measures were assessed by functional outcome: BCVA in each group in Log MARs, the patients 'demographics, the postoperative anterior segment complication, and posterior segment complications.

2.1. Ethical statements

This research was done after approval from the ethical committee at AL-Azhar university according to the guidance of the principles embodied in the Declaration of Helsinki. Its number is 'Oph._4med.Research._Optic.Disc.0000007' at the time from 8th July 2017 until 8th July 2023.

3. Results

3.1. We included 50 patients who were randomly divided into two groups

The Mean Difference Regarding BCVA Between both Studied Groups preoperatively was 2.628 ± 0.874 in group I and 2.824 ± 0.609 in group II. At 1st month postoperative it was 0.960 ± 0.210 in group I and 0.965 ± 0.178 in group II. In 3rd month postoperative, it was 0.828 ± 0.205 in group I and 0.780 ± 0.231 in group II. In the 6th month postoperative, it became 0.788 ± 0 0.237 in group I and 0.724 ± 0.211 in group II with no statistical differences between both groups (Tables 1 and 2). Post Operative OCT Findings for Both Groups: showed that at 3rd-month postoperatively the mean CMT in group I was 207.68 ± 23.119 and 188.48 ± 23.119 in group II. In 6th month the mean CMT was

Table 1. Gender distribution in the Studied Groups.

Variables	Studied Groups				Test of significance
	Group I		Group II		Chi-sq
	frequency	%	Frequency	%	*P* value
Sex:					
Male	14	56	15	60	Chi-sq = 0.082 $P = 0.774$
Female	11	44	10	40	

cases in group II at the follow-up in the 3rd and 6th months (Table 3), Figs. 1–3.

4. Discussion

One of the most common complications of vitrectomy in rhegmatogenous retinal detachment (RRD) is the formation of an Epiretinal membrane (ERM).[6] The ILM is very important for cell proliferation.

Table 2. The mean difference regarding BCVA between both studied groups.

Variables BCVA	Studied Groups		Test of significance	
	Group 1 Mean ± SD	Group 2 Mean ± SD	*T* test	*P* value
BCVA preoperatively	2.628 ± 0.874	2.824 ± 0609	0.635	0.239
BCVA at 1st Month	0.960 ± 0.210	0.965 ± 0.178	0.073	0.807
BCVA at 3rd Month	0.828 ± 0.205	0.780 ± 0.231	0.777	0.603
BCVA at 6th Month	0.788 ± 0 .237	0.724 ± 0.211	1.009	0.512

202.92 ± 27.371 in group I and 186.04 ± 14.194 in group II. As regards, the presence of ERM after 3rd month's follow up we found 7 patients in group I while no one was in group II. After 6 months, it was the same in both groups with a statistically significant difference. As regards IS/OS layer (EZ) disruption: we found 7 eyes in group I and 4 eyes in group II after 3 months post-operative and the disruptions remained the same in both groups 6 months postoperative. As regards the presence of DONFL there were no eyes in group I either at the 3rd or 6th-month follow-up, there were 5

These cells especially hyalocytes and glial cells are important for ERM development. Thus, ILM peeling may prevent ERMs through the eradication of these cells and removing its supporting matrix that helps their proliferation.[7] Our study assessed the role of peeling of ILM to prevent ERM development during vitrectomy for RRD and its beneficial effect on visual acuity improvement. At the end of the follow-up, we found that a significant number of patients (28%) who did vitrectomy without ILM peeling developed ERM. Even though there was no ERM formation in

Table 3. Post operative OCT findings for both groups.

Variables: OCT	Studied groups				Test of significance	
	Group I no. = 25 Mean ± SD		Group II no = 25 Mean ± SD		*t*-test	*P* value
CMT:						
3rd Month	207.68 ± 23.119		188.48 ± 23.119		2.395	0.237
6th Month	202.92 ± 27.371		186.04 ± 14.194		2.737	0.106
Variable	Frequency	%	Frequency	%	chi-sq	*P*-value
ERM(No. of eyes):						
3rd Month						
ERM	7	28	0	0.0	6.522	**0.011**
No ERM	18	72	25	100		
6th Month ERM						
ERM	7	28	0	0.0	8.93	**0.003**
No ERM	18	72	25	100		
IS/OS layer (EZ) disruption:						
3rd Month						
Disruption	7	28	4	16	1.049	0.248
Intact	18	72	21	84		
6th Month						
Disruption	7	28	4	16	1.049	0.248
Intact	18	72	21	84		
DONFL						
3rd month	0	0.0	5	20	0.660	0.804
6th month	0	0.0	5	20		

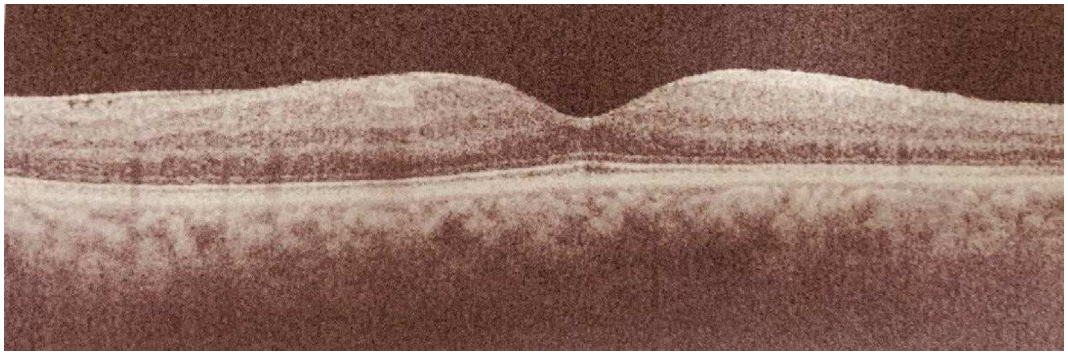

Fig. 1. Postoperative OCT for the patient without peeling showing faint parafoveal ERM, preserved retinal layer architecture, and intact ellipsoid zone.

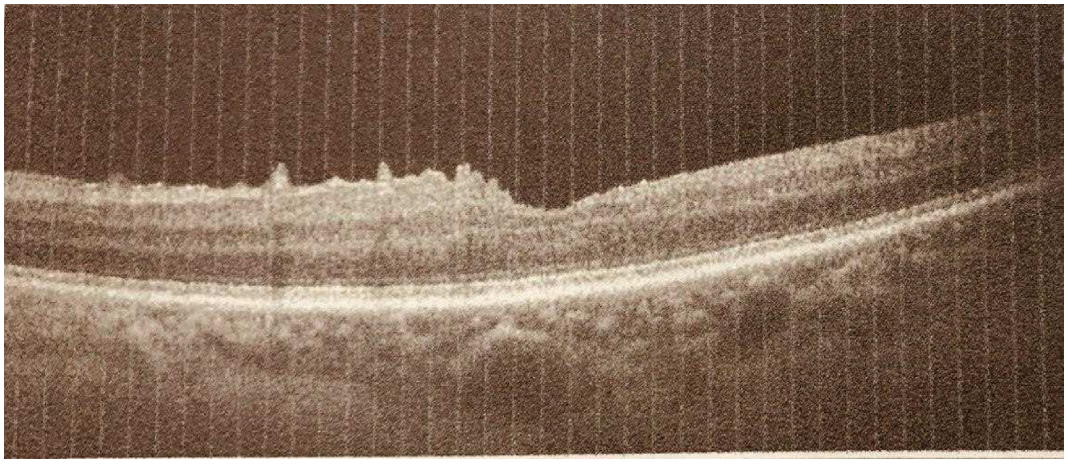

Fig. 2. Postoperative OCT for the patient without peeling showing ERM crossing the fovea causing tangential traction, preserved retinal layer architecture, preserved retinal contour, and intact ellipsoid zone.

the ILM peel group, the final BCVA showed no statistical differences between the two groups. The incidence of ERM without ILM peeling group showed a higher percentage than that of Heo et al. 2012[8] which was 6.1%, Martinez-Castillo et al. 2012[9] which was 8.97%, and Nam and Kim, 2015 which was 21.5%. However, our results are lower than that of Akiyama et al. (2016) showed 47.7% developed postoperative ERM in cases of vitrectomy without ILM. Rao et al.,[10] in 2013 reported 34.3% (11/32) of the non-peeling group developed ERM. Similarly, Forlini et al. 2018[11] showed the development of ERM in 31% of eyes without ILM peeling. In the present study, we did not report any ERM postoperatively in

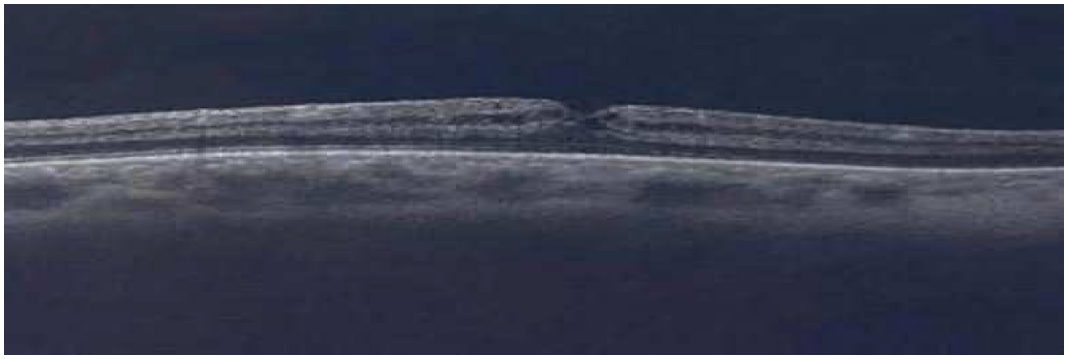

Fig. 3. Postoperative OCT for the patient with ILM peeling showing preserved retinal layer architecture, altered retinal contour with small cystic spaces interrupted ellipsoid zone.

ILM peeling group at the end of follow-up after 6 months. This result was better than that of Rao et al., 2013[10] who found that 3.3% (1/30) in the peeling group developed ERM. The effect of ILM peeling on the final BCVA was better in the group of ILM peeling[11–13]; on the contrary, some studies demonstrated that the visual acuity got worse in the ILM peeling group.[10,14,15] Other studies reported the visual acuity was the same in both procedures[16,17] which agrees with the results of our study. The intact ellipsoid zone was associated with better BCVA which agrees with Odrobina et al.,[18] who reported postoperative BCVA became improved with well-visible normal ellipsoid zone. In the present study, we found that macula off RD in both groups affects the postoperative BCVA. This could be explained by previous studies that reported anatomical restoration in the modern surgical techniques of RD repair, the visual results are still affected due to permanent macular functional damage.[19] Studying the factors affecting anatomical outcomes (ERM) in our patients, we found that multiple breaks were associated with more ERM development which agrees with the study done by Heo et al.,[8] and this was explained due to the easier dispersion of RPE cells through a larger break or larger RD. Some complications in the peeling group may be explained due to PPV even the advance of microincision surgery,[20] such as progression of cataracts, an increase of intraocular pressure[21] visual fields defect,[22] presence of retinal tears[23] development of retinal detachment,[24] hemorrhage inside the vitreous,[7] ocular hypotony,[25] phototoxicity of the macula,[23] changes in RPEs,[26] and finally endophthalmitis.[27] Other complications occurred due to macular peelings, such as focal edema or hemorrhage in the retina that resolved spontaneously with time.[28] Also, the presence of paracentral scotomas and visual field might be due to adjuvant stains or mechanical trauma during surgery were reported and mostly asymptomatic.[29] Some reported the development of retinoschisis[28] as well as macular edema.[30] In our study, we did not find the reported gross complications with ILM peeling. Several studies explained the complications from ILM peeling due to surgical mechanical trauma of retinal tissues.[11] So, the advance in the technique of ILM manipulation and staining reduce these complications in a great way. In conclusion; Our results confirm that there is an effective role of peeling of ILM to prevent ERM formation in eyes with RRD who have undergone PPV. The outcome of visual improvement is the same as the conventional treatment. This implies ILM role as a cause for the development of ERM and the need for the peeling of ILM. Postoperative OCT has vital in the detection and follow-up of macular changes that cannot be seen during ophthalmoscopically. With the presence of a significant percentage of ERM formation after the PPV procedure for the treatment of RRD, It is better to do a postoperative OCT assessment for all cases treated with PPV particularly that done without ILM peeling.

Conflicts of interest

Authors declared that there is no conflict of interest, no financial issues to be declared.

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