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Review Article

Internal Limiting Membrane Peeling Versus Non-Peeling in Diabetic Tractional Retinal Detachment Repair: Effects on Anatomical and Visual Outcomes

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Abstract

Purpose: This review explored whether adding internal limiting membrane (ILM) peeling to pars plana vitrectomy (PPV) influences postoperative outcomes in eyes with tractional retinal detachment (TRD) secondary to proliferative diabetic retinopathy (PDR).

Methods: A narrative literature review was conducted including comparative studies evaluating pars plana vitrectomy with and without ILM peeling for TRD secondary to advanced PDR. Eligible studies included randomized controlled trials, prospective interventional studies, and retrospective comparative cohort studies. Among postoperative outcomes, best-corrected visual acuity (BCVA) and epiretinal membrane (ERM) formation were the most prominently reported parameters.

Results: Across all included studies, retinal reattachment rates were generally high and comparable between ILM peeling and non-peeling groups. Postoperative ERM formation was consistently lower in eyes undergoing ILM peeling, with some studies reporting substantially reduced ERM incidence compared with non-peeling techniques. Findings regarding central macular thickness were variable across studies. Visual outcomes showed overall improvement following surgery in both groups; however, differences in final BCVA between ILM peeling and non-peeling groups were inconsistent. Rates of postoperative complications, including vitreous hemorrhage, recurrent retinal detachment, and neovascular glaucoma, were generally comparable between surgical approaches.

Conclusion: Despite inconsistent evidence regarding postoperative visual improvement, ILM peeling during diabetic vitrectomy was associated with potential anatomical advantages, including lower rates of postoperative ERM formation and reduced need for reoperation, without a clear increase in major complications. Therefore, ILM peeling may be beneficial in selected cases.

Keywords: *Internal Limiting Membrane Peeling; Pars Plana Vitrectomy; Tractional Retinal Detachment; Proliferative Diabetic Retinopathy; Epiretinal Membrane*

Key Messages

What is known?

- The benefit of ILM peeling in TRD surgery remains uncertain, with inconsistent evidence regarding its impact on visual outcomes despite potential anatomical advantages.

What is new?

- This study shows that despite these anatomical advantages, ILM peeling did not translate into a consistent improvement in visual acuity, highlighting a disconnect between structural and functional outcomes.
- Our findings suggest that ILM peeling may reduce the likelihood of secondary surgical intervention, reinforcing its potential role in selected cases.

Introduction

Among the advanced complications of proliferative diabetic retinopathy (PDR), tractional retinal detachment (TRD) remains one of the most vision-threatening conditions, often associated with significant anatomical disruption and poor visual outcomes [2,4,6,8]. Although pan-retinal photocoagulation and intravitreal anti-VEGF injections remain effective treatment options in selected stages of PDR, progression to tractional retinal detachment frequently necessitates surgical management with pars plana vitrectomy [2,6], particularly when traction involves the macular region. Pars plana vitrectomy (PPV) remains the standard surgical treatment for TRD associated with aiming to relieve tractional forces, reattach the retina, and improve visual outcomes [2,5,6,8]. In selected diabetic vitrectomy cases, surgeons may choose to perform ILM peeling as an adjunctive step aimed at minimizing postoperative epiretinal membrane (ERM) formation, as the ILM may act as a scaffold for glial cell proliferation [2,5-7,9]. However, the overall clinical value of ILM peeling remains debated, as some studies showed that ILM peeling can cause damage to the retina cells such as muller cells [2,6].

ILM peeling during pars plana vitrectomy has been associated with lower rates of postoperative epiretinal membrane (ERM) formation [1-3,5,6,8,9] and, in some reports, reduced postoperative central macular thickness (CMT) [1,6]. Despite these anatomical advantages, the effect of ILM peeling on final best-corrected visual acuity (BCVA) remains less clearly established [3,5].

Postoperative anatomical and functional outcomes following pars plana vitrectomy (PPV) for tractional retinal detachment (TRD) secondary to proliferative diabetic retinopathy (PDR) were analyzed in relation to internal limiting membrane (ILM) peeling status. Outcomes of interest included best-corrected visual acuity (BCVA), epiretinal membrane (ERM) formation, and central macular thickness (CMT).

Method

This study analyzed comparative studies investigating surgical outcomes of pars plana vitrectomy (PPV) performed with versus without internal limiting membrane (ILM) peeling in eyes with tractional retinal detachment (TRD) secondary to proliferative diabetic retinopathy (PDR).

Eligible studies included randomized controlled trials, prospective interventional studies, and retrospective comparative cohort studies. Studies were included if they reported outcomes in patients undergoing PPV for diabetic tractional retinal detachment and provided a comparison between ILM peeling and non-ILM peeling groups. The duration of postoperative follow-up varied among the included studies.

The outcomes of interest included both anatomical and functional parameters. Anatomical outcomes included central macular thickness (CMT) and epiretinal membrane (ERM) formation, while functional outcomes primarily focused on best-corrected visual acuity (BCVA). Postoperative complications reported by the included studies were also recorded.

For each included study, data were extracted regarding study design, sample size, group allocation, postoperative follow-up duration, anatomical outcomes, visual outcomes, and reported complications for each group.

Results

Anatomical outcomes

Primary retinal reattachment rates were generally high and comparable between ILM peeling and non-peeling groups. Successful retinal attachment was reported in the majority or all operated eyes, with no statistically significant difference between groups [2,4,6,7,9].

Postoperative epiretinal membrane (ERM) formation was reported at a lower frequency in eyes that underwent ILM peeling. One study reported ERM formation in 87.5% of eyes in the non-ILM peeling group compared with 18.75% in the ILM peeling group [9]. Similar trends were observed across multiple studies, all pointing towards a reduced incidence of postoperative ERM formation following ILM peeling [1-3,5,6,8]. Clinically significant ERM requiring reoperation was reported predominantly in non-ILM peeling groups, where one study reported 3 cases in the non-ILM peeling group requiring reoperation compared to 0 cases in the ILM peeling group [7]. Another study reported that 22.58% of the non-ILM group required reoperation versus 0% in the ILM peeling group [2]. Additionally, a third study reported a reoperation rate of 14.6% in the non-ILM peeling group compared to 0% in the ILM peeling group [6]. In addition, a fourth study reported the need for reoperation in 9 cases in the non-ILM group versus 5 cases in the ILM peeling group [1].

A trend toward lower postoperative CMT was observed in ILM peeling groups [1,6]; however, significant intergroup differences were not consistently identified across studies [1,2,5-9].

Visual outcomes

Best-corrected visual acuity (BCVA) improved from baseline in both ILM peeling and non-peeling groups in most studies. However, differences in final postoperative BCVA between groups were inconsistent. Although anatomical outcomes were dramatically improved in the ILM peeling group, similar results were not reported for final best-corrected visual acuity, as most findings were statistically insignificant [1,2,4,8,9], and only a few studies showed better visual outcomes [6,7]. One study reported greater visual improvement in the non-ILM peeling group despite a higher incidence of postoperative ERM formation [3].

Postoperative complications

Postoperative complications, including vitreous hemorrhage, recurrent retinal detachment, and neovascular glaucoma, were generally comparable between ILM peeling and non-peeling groups across the included studies [2,3,5-8]. However, reoperation rates were reported more frequently in non-ILM peeling groups, mainly due to secondary ERM formation with associated macular traction [1,2,6,7,8]. Some studies also reported NVG (Neovascular glaucoma) more frequently in non-ILM peeling groups [3,5,8]. In addition to that one study showed temporary intraocular pressure elevation occurred in non-ILM peeling group in 39% of the cases vs only 17.9% of the cases in ILM peeling group [6]. As for full thickness macular hole one study reported 2 cases among ILM peeling group and 0 cases in non-ILM peeling group [8].

Discussion

Among the included studies the findings suggest that ILM peeling provides a consistent anatomical benefit, particularly through the reduction of postoperative epiretinal membrane (ERM) formation [1-3,5,6,8,9].

Several studies included in this review demonstrated a markedly lower incidence of ERM formation in eyes undergoing ILM peeling compared with non-peeling groups [1-3,5,6,8,9]. This observation supports the concept that the ILM acts as a scaffold for glial cell proliferation, and its removal may therefore reduce the likelihood of postoperative epiretinal proliferation and secondary macular traction [2,5-7,9].

In addition to reducing ERM formation, some studies reported lower reoperation rates in ILM peeling groups, Secondary surgical intervention was most frequently required in cases where postoperative ERM formation resulted in persistent or recurrent macular

traction [1,2,6,8]. These findings highlight the potential anatomical advantages of ILM peeling in the surgical management of diabetic tractional retinal detachment.

Functional outcomes following ILM peeling remain controversial despite the anatomical improvements reported in several studies. Most included studies demonstrated postoperative improvement in best-corrected visual acuity (BCVA) after vitrectomy regardless of ILM peeling status [1,2,4,8]. While some studies observed superior visual outcomes in ILM peeling groups [5-7,9], others reported no significant differences between surgical techniques. Interestingly, certain reports described better postoperative visual improvement in non-ILM peeling groups despite higher rates of postoperative epiretinal membrane (ERM) formation [3]. Visual recovery may additionally be influenced by systemic factors such as elevated HbA1c levels and diabetic foot disease, both of which have been associated with poorer visual prognosis [2].

Anatomically, ILM peeling appeared to provide more consistent benefits. Reduced postoperative ERM formation and lower rates of recurrent macular traction were frequently observed in ILM peeling groups [2,5-7,9]. However, findings regarding central macular thickness (CMT) were less uniform across studies. Some reports demonstrated thinner postoperative macular thickness following ILM peeling [1,6], whereas others identified only numerically lower CMT values without statistically significant differences [2,5,7-9]. One included study reported that additional anti-VEGF therapy for persistent or recurrent macular edema was required more frequently in non-ILM peeling groups, affecting 35.48% of eyes compared with 7.7% in ILM peeling groups [2].

As for the ILM peeling approach, it has shown anatomical benefits; however, it carries its own risks, including potential damage to Müller cells, iatrogenic retinal breaks during surgical manipulation, delayed improvement in BCVA compared to no ILM peeling, an increased number of microscotomas, and inconsistent improvement in visual outcomes despite the observed anatomical effects [2,6,10].

Variability in postoperative visual outcomes may be influenced by multiple patient and disease related factors. Along with the surgical technique itself, the degree of macular ischemia plays a role, condition of optic nerve the chronicity of traction prior to surgery, the presence of diabetic macular damage, and systemic factors such as long-standing diabetes and glycemic control. As a result, improvements in macular anatomy do not always translate directly into superior functional outcomes [4].

Importantly, ILM peeling did not appear to increase the risk of major postoperative complications in the included studies. Rates of complications such as recurrent retinal detachment, vitreous hemorrhage, and neovascular glaucoma were generally comparable between ILM peeling and non-peeling groups [2,3,5,8]. Although some studies reported postoperative foveal thinning following ILM peeling, these changes were not consistently associated with worse visual outcomes and were not considered clinically significant in most cases [2,5,7-9].

Collectively, the available evidence indicates that ILM peeling during diabetic vitrectomy may contribute to favorable anatomical outcomes, particularly in reducing postoperative epiretinal membrane (ERM) formation and the need for secondary surgical intervention [1-3,5,6,8,9]. Nevertheless, visual outcomes remain variable across studies, with no consistent evidence of significant improvement in best-corrected visual acuity (BCVA) [1,2,4,8], emphasizing the importance of individualized intraoperative decision-making [5,7].

Conclusion

Current evidence suggests that ILM peeling during pars plana vitrectomy for diabetic tractional retinal detachment may provide anatomical advantages, particularly by lowering postoperative ERM formation and reducing the need for secondary surgical intervention [1-3,5,6,8,9]. Importantly, ILM peeling does not appear to increase the risk of major postoperative complications such as vitreous hemorrhage, recurrent retinal detachment, and neovascular glaucoma [3,5,6,8]. as for full thickness macular hole one was reported on one study with only 2 cases out of 64 cases [8].

However, the effect of ILM peeling on functional outcomes remains inconsistent. Although some studies reported improved visual acuity following ILM peeling, others demonstrated no significant difference in final best-corrected visual acuity compared with non-peeling techniques [1,2,4,8]. Therefore, ILM peeling may be considered a useful surgical adjunct in selected cases where the risk of postoperative ERM formation is high [5,7].

Further large-scale randomized controlled studies are required to better define patient selection criteria and clarify the functional benefits of routine ILM peeling in the surgical management of diabetic tractional retinal detachment.

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