EVALUATION OF OPTICAL COHERENCE TOMOGRAPHY AND VISUAL FIELD CHANGES AFTER VITRECTOMY AND ILM PEELING

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ABSTRACT

Background: Diffuse diabetic macular edema that does not respond to medicine or photocoagulation treatment can be successfully treated by vitrectomy. Cellular proliferations at the vitreomacular interface may be mitigated by removing the retinal internal limiting membrane (ILM), which may aid in macular edema resolution and macular whole closure.

Aim and objectives: to evulate changes in visual field and Optical Coherence Tomography (OCT) after viterctomy associated with ILM peeling.

Patients and methods: This prospective observational case-series research was done at the Out-Patient Clinic of the Department of ophthalmology, Assiut University Hospital. The study included thirty two eyes of thirty two cases who experienced vitrectomy and ILM Peeling. Macular OCT and visual field assessment were done both pre & post-operatively for all included patients.

Results: The visual field parameters showed statistically significant deterioration in the postoperative follow up visits. the postoperative mean defect significally increased to range from 9.2 to 11.7 dB. The lost variance (LV) showed statistically significant deterioration from the preoperative value which ranged from 4.2 to 7.6 dB to postoperative value which ranged from 6.2 to 9.8 db.

Conclusion: Our study revealed that; in spite of the significant postoperative improvement of the BCVA which was significantly correlated to the significant postoperative improvement of the central macular thickness, there was a significant deterioation of postoperative visual field parameters.

Keywords: Optical Coherence Tomography, visual field changes, vitrectomy, ILM Peeling.

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INTRODUCTION

Fibrocellular proliferation on the anterior side of the macula's ILM characterizes macular epiretinal membrane (ERM), a disease of the vitreomacular interface. The conventional surgical therapy for an ERM is a pars plana vitrectomy, which entails the excision of the ERM and the peeling of the inner limiting membrane. In order to stop ERM from happening again, it is necessary to peel away the ILM and remove the scaffold for myofibroblast proliferation as well as any microscopic ERM. In addition to ERM, other illnesses, such as diabetic macular edema and macular hole, have indications for ILM peeling. Retinal function can be altered due to the traumatic nature of ILM peeling, which affects the inner retinal layers below **[1, 2].**

The well-documented complications resulting from the combined toxicity of the stains and the surgical stress of peeling include retinal edema, eccentric scotoma, dissociation of the nerve fiber layer, and subretinal, retinal, and vitreous hemorrhage. The development of minimally traumatic methods for removing the ILM may be aided by research into these modifications **[3].**

Visual field testing and OCT may be used to evaluate functional changes. The etiology of visual field loss following vitrectomy is unknown, despite being a common post-operative complication, especially in eyes that underwent fluid air exchange **[4].**

To assess the inner retinal layers following ILM peeling, OCT imaging is used. High myopic eyes are at risk for more severe, "scattered" inner retinal abnormalities **[5].**

This work aimed to evaluate changes in visual field and OCT after vitrectomy associated with ILM peeling.

PATIENTS AND METHODS

This prospective observational case series research was done at Assiut University Hospital from December 2020 to December 2021 with a follow up period of 6 month.

The research involved 32 eyes of 32 cases. All patients were fully informed about the risks and benefits of the study. The consent was obtained in writing.

Study protocol was submitted for approval by the Ethical Committee of faculty of medicine - Assiut University.

Inclusion criteria: Idiopathic ERM, lamellar macular hole, Vitreomacular traction Primary full thickness macular hole & Diabetic retinopathy.

Exclusion criteria:

Cases with a secondary ERM, following (Venous occlusion, Uveitis, Retinal detachment & Trauma) and previous retinal surgery

Methods

Pre, and post -operative evaluation include: Detailed history was taken to document onset and progression of symptoms, other ocular diseases (such as glaucoma, cataract ,other retinal disease ,etc), All patients' demographic information (age, sex, domicile, etc.) and ocular examination results were documented, and a history of systemic disease, comparable sickness in other members of the family, trauma, or past ocular procedures was recorded if known.

Surgical procedures

vitrectomy and ILM Peeling

The vitrectomy surgeries were carried out by different surgeons.

Operations were conducted using a 27-gauge pars plana vitrectomy with Carl Zeiss Meditec AG 700, Triamcinolone acetonide was administered in all cases to enhance visualization of the vitreous. Additionally, it was utilized to aid in the induction of posterior vitreous detachment (PVD) in eyes that did not already have a PVD. The ERM was manually grasped and peeled using end-gripping forceps. Prior to peeling, Brilliant blue G dye was applied to stain the ILM. The ILM was then directly grasped and peeled using end-gripping forceps within a specific area around 10 degrees away from the fovea.

Research outcome measures

Primary (main): Visual field main parameters and central macular thickness after ILM peeling**.**

Secondary outcome: best corrected visual acuity (BCVA) after ILM peeling**.**

Ethical Considerations: The Ethical Committee of the Faculty of Medicine at Assiut University has been presented with the study protocol for their consideration and approval. Every patient gave their verbal and written permission to the procedure before it was performed, and the confidentiality of their information and their right to personal privacy were protected at every stage of the research project.

Statistical analysis

The software program Microsoft Excel was used to code, input, and analyze the data that was obtained during the history, basic clinical examination, and outcome measurements. After that, the information was prepared for analysis by being imported into the program known as Statistical Package for the Social Sciences (version 21.0) (Statistical Package for the Social Sciences). Based on the type of data qualitative describe as number and percentage, quantitative continues group describe by mean ± SD, the following tests were utilized to assess differences for significance;. The Chi square test (X2) evaluates the differences and associations between qualitative variables. The t test allows us to contrast the differences among quantitatively independent groups. The threshold for significant findings was set at 0.05, while the threshold for very significant results at 0.001.

The EPINFO application was used to do the calculation for the sample size.

RESULTS

Table (1): Demographic and pre-operative data

Variable	Study population (n = 32)	
	Mean ± SD.	Range
Age	**60.7 ± 2.5**	**56 - 66**
Systolic Blood Pressure (mmHg)	**134.6 ± 19.66**	**110 - 160**
Diastolic Blood Pressure (mmHg)	**89.9 ± 9.07**	**70 - 100**
Pre-operative IOP (mm Hg)	**19.4 ± 1.54**	**18 – 22.5**
Pre-operative BCVA (logMAR)	**0.57 ± 0.19**	**0.32 -0.8**
Pre-operative Mean defect (MD) (dB)	**5.3 ± 0.74**	**4.2 – 6.7**
Pre-operative Loss variance (LV) (dB)	**5.86 ± 1.29**	**3.3 - 8.4**
OCT foveal thickness (µ)	**400.8 ± 50.82**	**290 - 473**

SD: standard deviation

The study included thirty two eyes of thirty two patients, 13 of them were males (40,6%), and 19 of them were females (59,4%), with a mean age of 60.7 ± 2.5 years.

The preoperative systolic blood pressure (SBP) in patients included in this study varied from 110 to160 mmHg with a mean of 134.6 ± 19.66mmHg, while the diastolic blood pressure (DBP) ranged from 70

to 100 mmHg with a mean of 89.9 ± 9.07 mmHg (table 1).

The BCVA varied from 0.32 to 0.8 logMAR with a mean of 0.57 ± 0.19, preoperatively (table 1).

Table (2): Pre and Post-operative data with the significance of change

Variable	Study population (n = 32)		
	Pre-operative	Post-operative	p
IOP (mm Hg)	**19.4 ± 1.54**	**18.59 ± 1.19**	**0.202**
BCVA (logMAR)	**0.57 ± 0.19**	**0.36 ± 0.17**	**0.019**
Mean defect (MD) (dB)	**5.3 ± 0.69**	**10.3 ± 0.74**	**<0.001**
Loss variance (LV) (dB^2)	**5.86 ± 1.29**	**7.88 ± 1.34**	**<0.001**
OCT foveal thickness (µ)	**400.8 ± 50.82**	**307.6 ± 25.21**	**<0.001**

SD: standard deviation

The visual field parameters showed statistically significant deterioration in the postoperative follow up visits. the postoperative mean defect significally increased to range from 9.2 to 11.7 dB with a mean of 10.3 ± 0.74 db (p<0,001). The LV showed statistically significant deterioration from the preoperative value which ranged from 4.2 to 7.6 dB with a mean of 5.86 ± 1.29 db. to postoperative value which ranged from 6.2 to 9.8 db with a mean of 7.88±1.34 (p<0,001).

Table (3): Disease entities underwent vitrectomy with ILM peeling

Types of diseases	ILM peeling patients (n = 32)	
	n	%
Macular hole	**6**	**18.8%**
ERM	**11**	**34.4%**
VMT	**5**	**15.6%**
Diabetic retinopathy	**10**	**31.3%**
associated cataract phacoveterectomy	**12**	**37.5%**
Cases with preoperative glaucoma	**5**	**15.6%**

There were 6 eyes (18.8%), that had preoperative macular hole, 11 eyes (34.4%) that had ERM, 5 eyes (15.6%) had vitreomacular traction, 10 eyes (31.3%) had diabetic retinopathy, 12 eyes (37.5%) had coexisting cataract, and 5 eyes (15.6%) had preoperative glaucoma.

Table (4): correlation between the postoperative MD with age, SBP, DBP, preoperative IOP or postoperative IOP

Variable	Post operative MD	
	Pearson's correlation coefficients (r)	P value
AGE	**0,026**	**0,878**
SBP	**-0,065**	**0,724**
DBP	**0,011**	**0,951**
Preoperative IOP	**-0,057**	**0,756**
Post-operative IOP	**-0,033**	**0,856**

There was no significant association amongst the postoperative visual field MD with age, SBP, DBP, preoperative IOP or postoperative IOP (table 4).

Table (5): correlation between the postoperative loss of variance (LV) with age, SBP, DBP, preoperative IOP or postoperative IOP

Post operative loss variance		
Variable	**Pearson's correlation coefficients (r)**	**P value**
AGE	**0,153**	**0,403**
SBP	**-0,043**	**0,816**
DBP	**0,092**	**0,615**
Preoperative IOP	**-0,024**	**0,896**
Post operative IOP	**0,008**	**0,964**

Similarly, there was no significant correlation between the postoperative loss of variance (LV) with age, SBP, DBP, preoperative IOP or postoperative IOP.

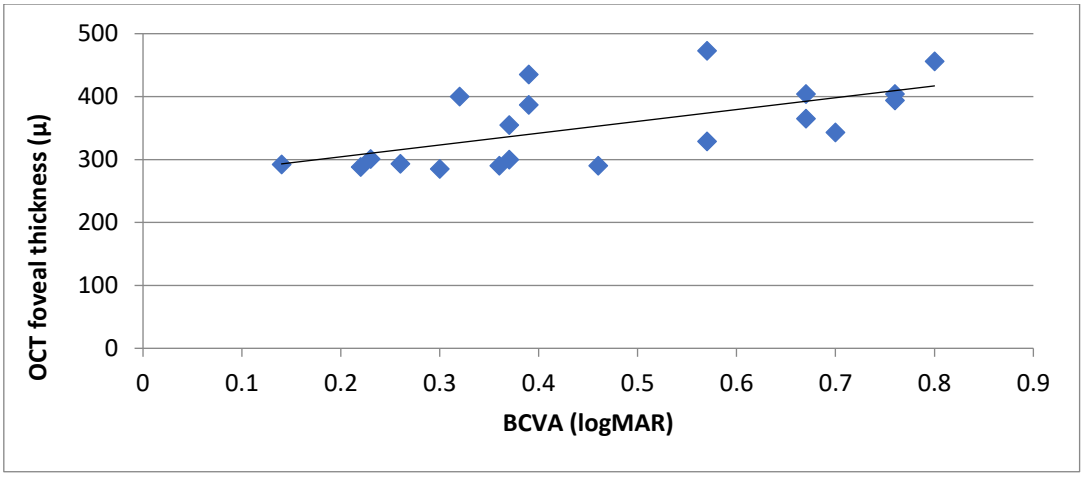

Figure (1): Scatter plot graph showing correlation between BCVA (logMAR) and OCT foveal thickness (µ).

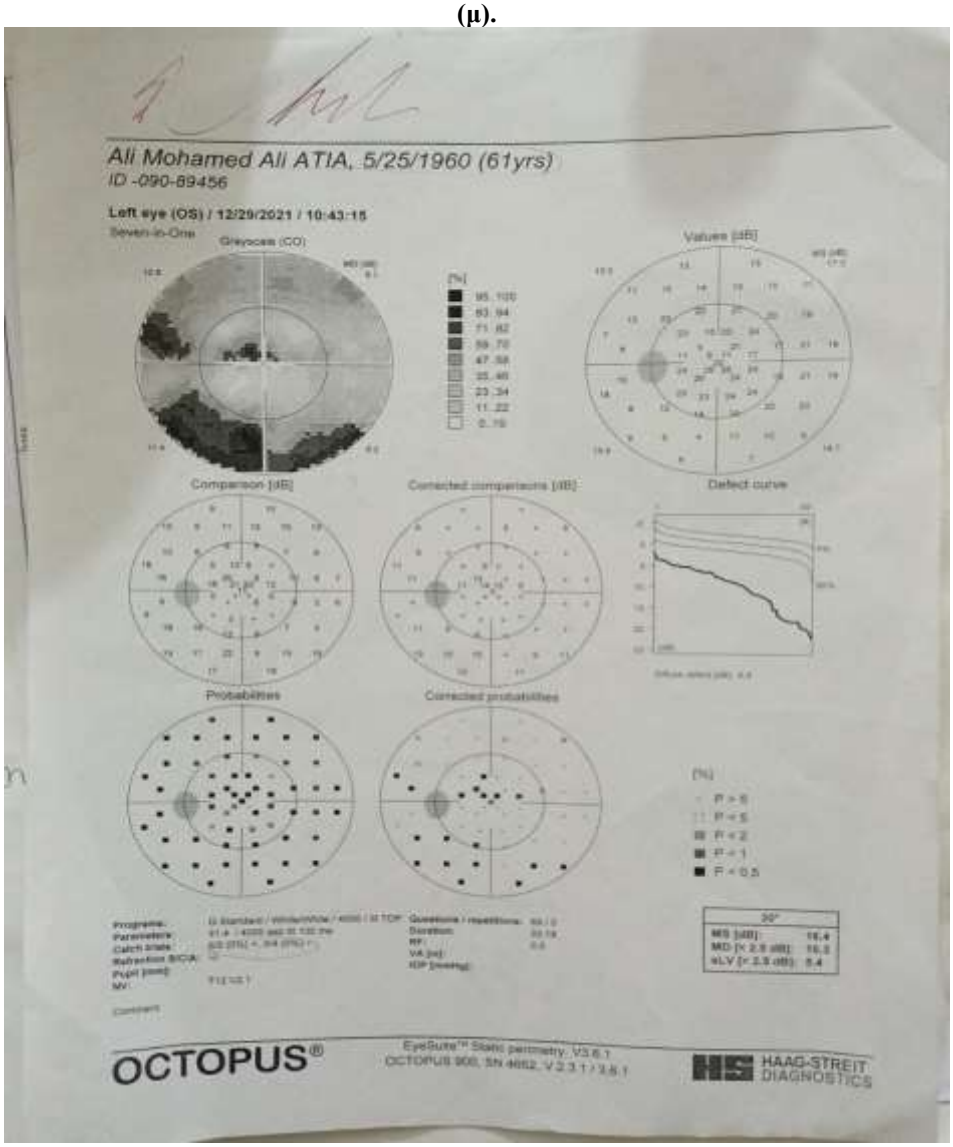

Fig 2-A: Pre-Operative visual field printout

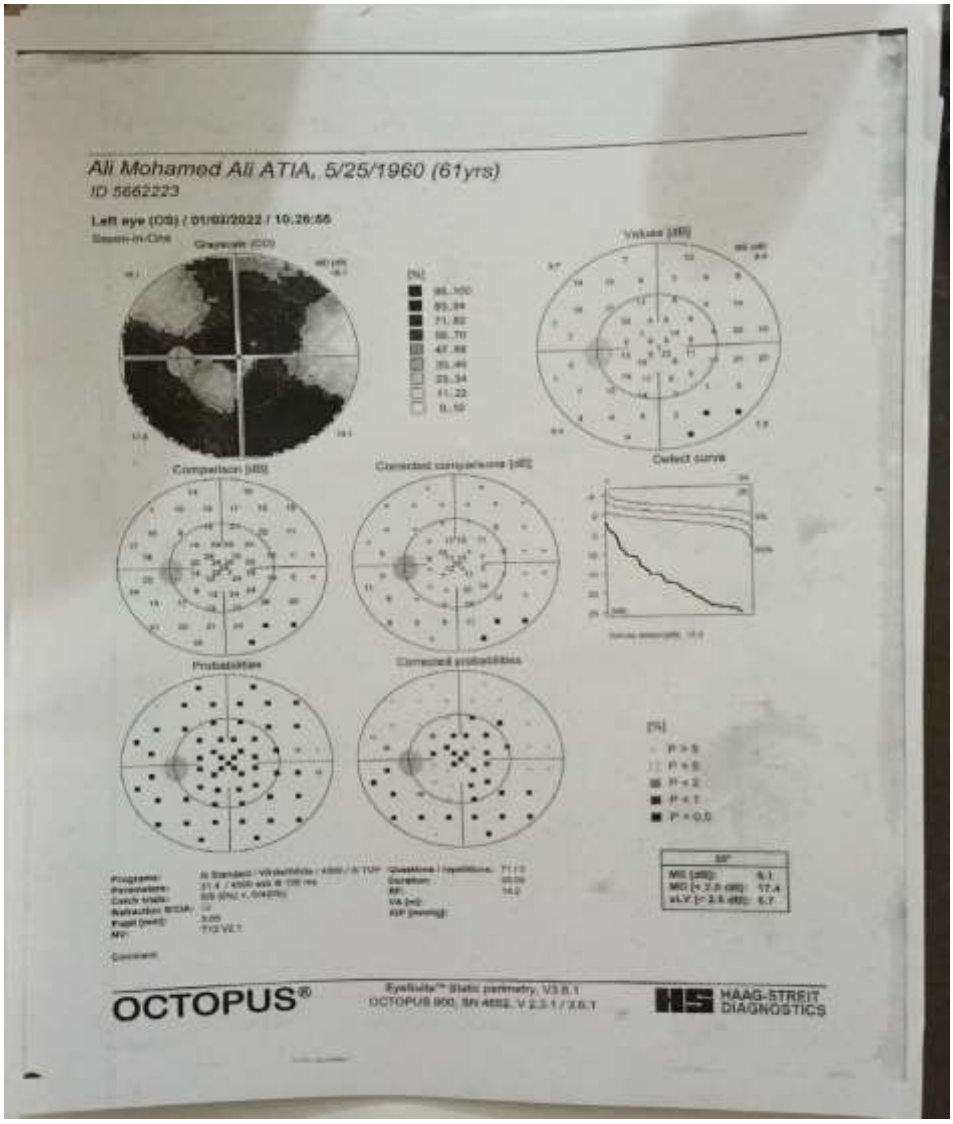

Fig 2-B: Post-Operative visual field printout

DISCUSSION

The mean age of the cases in this research was 60.7 ± 2.5 years, 59.4% of them were females which was consistent with reports from **Liu et al.[6].** However, **Won et al. [7]** reported older age sample with a mean patient age of 64.3 years & 69.2 in these studies respectively.

The mean Systolic Blood Pressure of the cases involved in the current research was 134.6 ± 19.66 mmHg while the mean diastolic pressure was 89.9 ± 9.07 mmHg which was in accordance with reports of **Yamada et al. [8]** and **Cheng et al. [9]**Systemic hypertension was reported to affect the blood flow in perifoveal capillaries and optic nerve head, which is further reduced during PPV in response to an elevated intraoperative infusion pressure resulting in exacerbation of visual field damage.

The mean postoperative Intra ocular pressure (IOP) didn't show statistically significant difference from the mean preoperative measurement (p= 0.202), which was in agreement with **Tsuchiya et al. [10]** who reported similar results (P = 0.88).

On the other hand, the mean postoperative decrease in the central macular thickness was found to be statistically significant (p= <0.001) when contrasted with the mean Pre-operative measurements. A similar finding was also stated by **Okawa et al. [11]**. A statistically significant increase in mean defect (MD) and measurements of loss of variance (LV which is the same as the pattern standard deviation PSD) was noted in the current study which was consistent with previous report from **Stalmans et al. [12]**

The consistency of our findings with **Uemura et al. [13],** who stated statistically significant difference before and after the operation in regard to Mean defect. They found that four out of seven individuals who had deliberate ILM peeling experienced significant visual field loss following surgery. Three out of four individuals had abnormalities in their nasal vision fields that had the appearance of a wedge. The field of vision was severely restricted in one case. The other eye showed no signs of

homonymous visual field abnormalities. Similar results were reported by **Akino et al.[14]**

Similarly, **Tsuchiya et al. [15]** stated that MD and PSD significantly deteriorated postoperatively in the glaucoma group (33 eyes).

Likewise, **Kaneko et al. [16]** 18 eyes participated in the research that all had ERM and glaucoma with a hemifield deficiency. These eyes were significantly less sensitive at 5/26 points, mostly in the nasal area of the glaucomatous hemifield, contrasted with just 1/26 points in the normal hemifield .

Postoperative BCVA was demonstrated to correlate significantly (P = 0.003) with foveal thickness in OCT. Reduced retinal thickness and absorption of subretinal fluid have been related to the functional improvement. This was in accordance with results stated by **Chen et al.[17]**.

The postoperative mean BCVA measurement revealed a statistically significant improvement (p= 0.019) from the mean Pre-operative BCVA which was consistent with reports **[10, 15, 16].**

However, our findings were in disagreement with **Obata et al. [18]** They found no statistically significant variations in BCVA among the groups either prior to or following surgery. There may have been no change in postoperative visual acuity since this study included even ERMs that recurred slightly at the foveal and/or extrafoveal zone. **Taniuchi et al. [19]** reported similar findings, highlighting the fact that numerous factors besides anatomical success and macular hole repair might influence visual acuity, making assessment challenging. The timing of the procedure and the extent of any preexisting conditions may have an impact on the final visual results.

In the current study, we found no significant Correlation between Age, SBP, DBP, preoperative IOP and postoperative IOP, on the one hand, and mean defect and loss of variance on the other hand. Our findings were in disagreement with **Akino et al. [14],** who reported a significant Correlation between Age and post-operative MD. Postoperative visual function and surgical results are significantly impacted in older individuals by both the natural aging process and delays in surgical intervention.

The Postoperative complications in our study included Full thickness macular hole (9.4%), Retinal detachment (9.4%) or both (19%).

The total cases with FTMH were 6 eyes (19%) which was along with a research by **Shimada et al. [20],** who stated 16.7% incidence of FTMH. This was contrary to other reports that did not encounter such complications **[21, 22]**.

The total eyes with Retinal detachment were 6 eyes (19%). This was significantly greater than other reports of **Sborgia et al. [22]** who reported only 1.5% incidence of retinal detachment.

This study has encountered several limitations. One of the major limitations is the small sample size, which can be attributed to the fewer number of patients who met our inclusion & exclusion criteria during the study period of one year during Covid-19 lockdown. This, along with the absence of a control group in the current investigation, suggests significant disparities in the follow-up may have happened even if the surgical therapy had not been carried out. Another significant limitation is that we did not take into account the severity of the symptoms over time as a parameters. Also the lack of data about the influence of surgery on different retinal layers, and of changes in the shape and depth of visual field scotoma, are important limitation of our study. But this was because of lack of these data in the postoperative follow-up visits of some patients whom postoperative data were collected by the treating surgerons at their private clinics.

CONCLUSION

Our study revealed that; in spite of the significant postoperative improvement of the BCVA which was significantly correlated to the significant postoperative improvement of the central macular thickness, there was a significant deterioation of postoperative visual field parameters. This deterioation was not correlated to any of the age of patient, his blood pressure or his pre and postoperative IOP.

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