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Pre and Postoperative OCT Findings Following Management of Diabetic Vitreoretinal Traction Maculopathy Using 23 Gauge Vitrectomy

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Abstract

Background: *Pars Plana Vitrectomy (PPV) is an essential surgery for advanced diabetic retinopathy, particularly in cases had vitreous hemorrhage or traction. The 23-gauge system improves safety and precision in such procedures.*

Aim: *To assess central macular thickness utilizing Optical Coherence Tomography (OCT) before and after 23-gauge vitrectomy in cases had diabetic vitreoretinal traction maculopathy.*

Patients and methods: *This retrospective research included 48 eyes had vitreomacular traction and diabetic macular edema (DME). Visual acuity ranged from 0.5 to 1.3 LogMAR, and central macular thickness measured by OCT was greater than 300 microns. Follow-up visits were conducted every 2-months, with the 6-month visit serving as the study endpoint. The investigation has been performed at the Research Institute of Ophthalmology (RIO).*

Results: *The study included 48 eyes with a mean age of 65.6 years. Preoperative mean Central Macular Thickness (CMT) was 475 µm and BCVA was 1.03 LogMAR. At 2 months postoperatively, 70% showed >50 µm CMT reduction; at 6 months, 66% maintained this reduction. BCVA improved in 22% at 2 months and 25% at 6 months, with 52–58% showing no change. Postoperative complications occurred in 33% of eyes, and lens changes developed in 78% of phakic eyes. Poor final BCVA (≥1.3 LogMAR) was significantly associated with baseline BCVA <1.3 and ischemic macula (P<0.001).*

Conclusion: *Vitrectomy is beneficial for chronic VMT, particularly in younger patients with good vision and non-ischemic macula, and can still yield positive outcomes after 6 months.*

Keywords: *Diabetic macular edema, vitreomacular traction, pars plana vitrectomy, central macular thickness.*

1. INTRODUCTION

A number of diabetic retinopathy complications need surgical management. PPV in diabetic cases has multiple recognized indications; clearing of media opacities, Vitrectomy offers relief from retinal traction, and stabilizes the proliferation process. Vitreous bleeding, severe fibrovascular proliferation with traction retinal detachment, and traction-rhegmatogenous retinal detachment influencing or threatening the macula are classic indications for pars plana vitrectomy, while diffuse macular edema is a nonstandard indication for this process (1).

Macular edema is a 1ry etiology of loss of vision incases had non-proliferative diabetic retinopathy (NPDR). It additionally frequently leads to loss of vision in proliferative diabetic retinopathy (PDR) (2).

As newer concepts in the understanding of DME highlight the important role of vitreomacular traction in this condition. Certain eyes exhibiting macular edema may present with subtle, localized perifoveal vitreous detachment, potentially inducing anterior traction on the foveola, leading to Mult cystoid foveal thickening without the formation of a macular hole or capillary leakage (2).

Cases exhibiting macular edema, characterized by a taut, partial vitreomacular separation and thickened posterior hyaloid, are correlated with subfoveal detachment and subretinal fluid (3).

Cases exhibiting macular edema, characterized by a taut, thickened posterior hyaloid and partial vitreomacular separation, are correlated with subfoveal detachment and subretinal fluid (4).

Optical Coherence Tomography is a diagnostic method that permittes a high-resolution, cross-sectional image of the retina. It has become as a crucial instrument in the diagnosis of macular conditions. Optical Coherence Tomography has allowed it probable to superior understanding of the vitreoretinal

relation at the macula (5).
Claus Eckardt first described 23-gauge transconjunctival sutureless vitrectomy (TSV). The twenty-three-gauge system obviates certain of the short comings of twenty-five-gauge systems, as the tools exhibit reduced flexibility and perform more like twenty-gauge tools, permitting more thorough peripheral vitrectomy and great complex maneuvers. This instrument system develops tunneled sclerotomies utilizing a slanted MVR blade, followed by a blunt trocar that gives a self-sealing incision. Furthermore, the cutting tip is closer to the edge of the vitrector, so facilitating the dissection of fibrovascular proliferations appearing in diabetic retinopathy. Nevertheless, 23-gauge vitrectomy systems remain certain critical restrictions of twenty-five-gauge systems, like a lack of a fragmatome, that may be required in instances of combination operation with dense cataracts (6).
The objective of this research was to evaluate central macular thickness using OCT before and after 23-gauge vitrectomy in patients with diabetic vitreoretinal traction maculopathy.

2. PATIENTS AND METHODS

This investigation included 48 eyes with DME and vitreomacular traction, visual acuity ranged between 0.5-1.3 LogMAR, central macular thickness by OCT >300 microns. Monitoring visits have been carried out every 2 months &at 6 months was the end point. The study was performed at the Research Institute of Ophthalmology (RIO).
Inclusion Criteria: Vitreomacular traction as the indication for vitrectomy; central macular thickness with OCT of not less than 300 micrometers; Best Corrected Visual Acuity not more than 0.5 LogMAR; pupillary dilation, media clarity, and subject cooperation adequate for adequate fundus imaging; capability of return for regular research visits.
Exclusion Criteria: Previous pars plana vitrectomy; other major ocular operation within 6 months; a history of macular photocoagulation, intravitreal injection, or other management for diabetic macular edema within three months; proof of ocular disorders that could possibly lead to macular edema, like uveitis; visually significant cataract (more than grade +2); history of glaucoma or ocular hypertension.

METHODS

All patients were evaluated preoperatively with BCVA measurement, intraocular pressure assessment, slit-lamp and dilated fundus examination, OCT for macular thickness, and fluorescein angiography for PDR and macular ischemia. Written informed consent was obtained after explaining study goals, possible risks (e.g., retinal detachment, hemorrhage), and potential need for further treatments (laser or intravitreal injections). All cases were performed at the Research Institute of Ophthalmology operating theatre. All patients underwent transconjunctival sutureless 23-gauge pars plana vitrectomy (PPV). Pupil dilation was achieved using cyclopentolate 1% and mydriacyl 1%; in poorly dilated cases, intracameral adrenaline (1:10000) was used. Peribulbar anesthesia was administered by the anesthesiologist. Sterilization included ten percent povidone-iodine for the eyelids and five percent povidone-iodine drops for the conjunctival sac. A non-permeable adhesive drape isolated the lids and lashes. A 23-gauge three-port valved trocar system was inserted via transconjunctival sclerotomies at 4 mm (phakic) or 3.5 mm (pseudophakic) from the limbus—lower temporal for the infusion cannula and upper ports for instruments. Core vitrectomy has been carried out, followed by posterior vitreous detachment (PVD) induction using high vacuum vitrector and/or soft-tip cannula; triamcinolone assisted in visualizing and removing the vitreous cortex. Epiretinal membrane (ERM) was removed using end-gripping forceps. Areas of intraocular hemorrhage were managed by temporarily raising intraocular pressure or, when needed, endodiathermy. Fluid-air exchange was carried out with extrusion or flute needle. Endolaser was applied to seal iatrogenic breaks and for focal or scattered retinal photocoagulation as required. In cases needing tamponade, silicone oil was injected in exchange with air. Sclerotomies were sealed via massage, bipolar cautery, or 7-0 Vicryl sutures if necessary. Subconjunctival dexamethasone (8 mg/2 ml) and gentamycin (80 mg/2 ml) were administered. Postoperative treatment included moxifloxacin 5.45 mg/ml and prednisolone acetate 1% eye drops.

Follow-Up Visits: Monitoring visits have been conducted at one day, two months, four months, and six months within pre-specified time windows. During every visit, an interval history was obtained, involving surgical and medical management for the study eye. At baseline and during each monitoring visit, best-corrected visual acuity has been assessed, and OCT images have been gained using a dilated pupil

Statistical methods

Information has been statistically characterized by mean (average) (± SD), median, range, or frequencies (number of cases) and percentages as available. The comparison of numerical parameters among the study groups has been conducted utilizing the Chi-square (χ^2) test. The Student's t-test for independent samples has been conducted to compare categorical data. Association among qualitative parameters tested by bivariate analysis. P values below 0.05 have been regarded statistically significant. All statistical calculations have been conducted utilizing SPSS (Statistical Package for the Social Sciences; SPSS Inc., Chicago, IL, United States of America) version 23 for Microsoft Windows.

3. RESULTS

In this study, the average case age was around 65.6 years, with a nearly equal split between males (52%) and females (48%). Before surgery, the average central macular thickness (CMT) was about 475 microns. After the vitrectomy, most eyes showed improvement. At two months, 70% of eyes had a CMT reduction of more than 50 microns, while 10% actually showed an increase. By six months, 66% had a reduction over 50 microns, and 14% showed an increase. Between the second and sixth month, most eyes stayed stable or continued to improve, though a few worsened slightly. Overall, the surgery led to a meaningful decrease in macular thickness for most patients (Table 1).

Table (1): Showing preoperative mean CMT and postoperative mean CMT at 2 and 6 months

Preoperative CMT	**Postoperative CMT after two months**	**Postoperative CMT after six months**
474.7083 ranges from 449.4580 to 499.9587	**432.7083 ranges from 413.6962 to 451.7205**	**418.2917 ranges from 401.1585 to 435.4248**

The preoperative mean BCVA was 1.0312 (ranging from 0.9410 to 1.1215). Postoperatively, BCVA showed initial improvement at 2 months in 11 eyes (22%)—with 5 eyes (10%) gaining 2 lines, 4 eyes (8%) gaining 1 line, and two eyes (four percent) gaining 3 lines. However, 12 eyes (25%) showed a decline (11 eyes lost 3 lines, 1 eye lost 6 lines), while 25 eyes (52%) remained stable. At 6 months, BCVA improved in 12 eyes (25%)—five eyes (10%) gained 2 lines, 5 eyes (10%) gained one line, and two eyes (four percent) gained 3 lines. A decrease was seen in 8 eyes (16%), and 28 eyes (58%) had no change. Between 2 to 6 months, the initial 11 improved eyes remained unchanged, while 4 of the 12 eyes with prior BCVA decrease improved by 3 lines and one eye by 4 lines. Overall, 41 eyes (85%) showed no further change between the 2nd and 6th months (Table 2)

Table (2): Showing preoperative mean BCVA and postoperative mean BCVA mean at 2 and 6 months

Preoperative BCVA	**Postoperative BCVA after 2 months**	**Postoperative BCVA after 6 months**
1.0312 ranges from 0.9410 to 1.1215	1.0708 ranges from 0.9763 to 1.1653	1.0500 ranges from 0.9496 to 1.1504

Out of 48 patients, 16 eyes (33%) had postoperative complications within 6 months, mainly vitreous hemorrhage and retinal detachment, with 4 eyes losing 10 or more letters. Lens changes developed in 28 of 36 phakic eyes (78%). Only two preoperative factors were significantly linked to poor final BCVA (≥1.3 LogMAR): worse initial vision (P below 0.001) and ischemic macula (P under 0.001). Other factors like diabetes type, duration, prior treatments, and lens status showed no significant impact on visual outcome (Table 3)

Table (3): Postoperative Complications

Postoperative complications	**16 (33%)**	**Management**
Vitreous hemorrhage	5 (10%)	**Semi-setting position Follow up**
Elevated IOP requiring treatment	7 (14%)	**Medical treatment**
Retinal detachment	3 (6%)	**23 guage vitrectomy Silicon oil injection**
Retinal tear	0	
Endophthalmitis	0	
Macular ischemia	0	
Double vision	0	
Lamella hole	0	
Choroidal effusion	**1 (1%)**	**Peribulbar steroid injection**

The current study showed acceptable outcomes compared to previous studies, with an anatomic success rate of 85.4% and 83.3% of eyes showing improved or stable vision. Notably, no eyes ended with no perception of light (PL). The percentage of eyes with final BCVA ≥1.0 LogMAR (43.8%) was lower than in studies such as Aabunajma et al. and Steinmetz et al., but better than that reported by Castellarin et al. The relatively short monitoring duration (6 months) may have limited the ability to capture long-term visual changes or complications. Overall, the results indicate satisfactory anatomical and visual outcomes in comparison to the literature (Table 4).

Table (4): Summary of certain researches reporting vitrectomy outcomes for diabetic vitreomacular traction over the past 3 decades

Authors	**Number of eyes**	**Final visual acuity ≥1.0 LogMAR, number of eyes (percent)**	**Vision improved, or stabilized, number of eyes (percent)**	**Final anatomic success rate after PPV, number of eyes (percent)**	**Eyes ending with no PL, number of eyes (percent)**	**Follow-up (months)**
Current study	48	20 (43.8%)	40(83.3%)	41(85.4%)	0	**6**
Aabunajma et al117	96	83 (86.4%)	84(87.5%)	87 (90.6%)	3 (3%)	**15**
Castellarin et al118	23	5 (22%)	13 (57%)	20 (87%)	2 (9%)	**5.4(mean)**
Steinmetz et al119	67	47 (70%)	51 (72%)	62 (93%)	0	**16(mean)**
Meier et al120	28	9 (32%)	25 (89%)	27 (96%)	5 (18%)	**14(mean)**
Williams et al121	69	49 (71%)	49 (71%)	57 (83%)	0	**6**
Thompson et al122	360	259 (72%)	239 (66%)	274 (76%)	67 (19%)	**13**
Abrams and Williams et al123	16	11 (69%)	13 (81%)	13 (81%)	2 (13%)	**6.5(mean)**
Rice et al124	197	116 (59%)	129 (65%)	130 (66%)	37 (19%)	**12**
Rice and Michels125	107	59 (55%)	63 (59%)	68 (64%)	22 (21%)	**12**
Aaberg126	**125**	**90 (72%)**	**90 (72%)**	**84 (67%)**	**14(11%)**	**39 (mean)**

Example.1

Patient no.7, A male patient 58 years old referred from medical retina clinic in RIO to our surgical retina clinic he presented with PDR in his Rt eye, pan retinal photocoagulation was done 6 months ago, best corrected vision was o.7 LogMAR, OCT was done showing vitreo- macular traction with cystoids macular edema, central macular thickness was 431µ. Figure 1

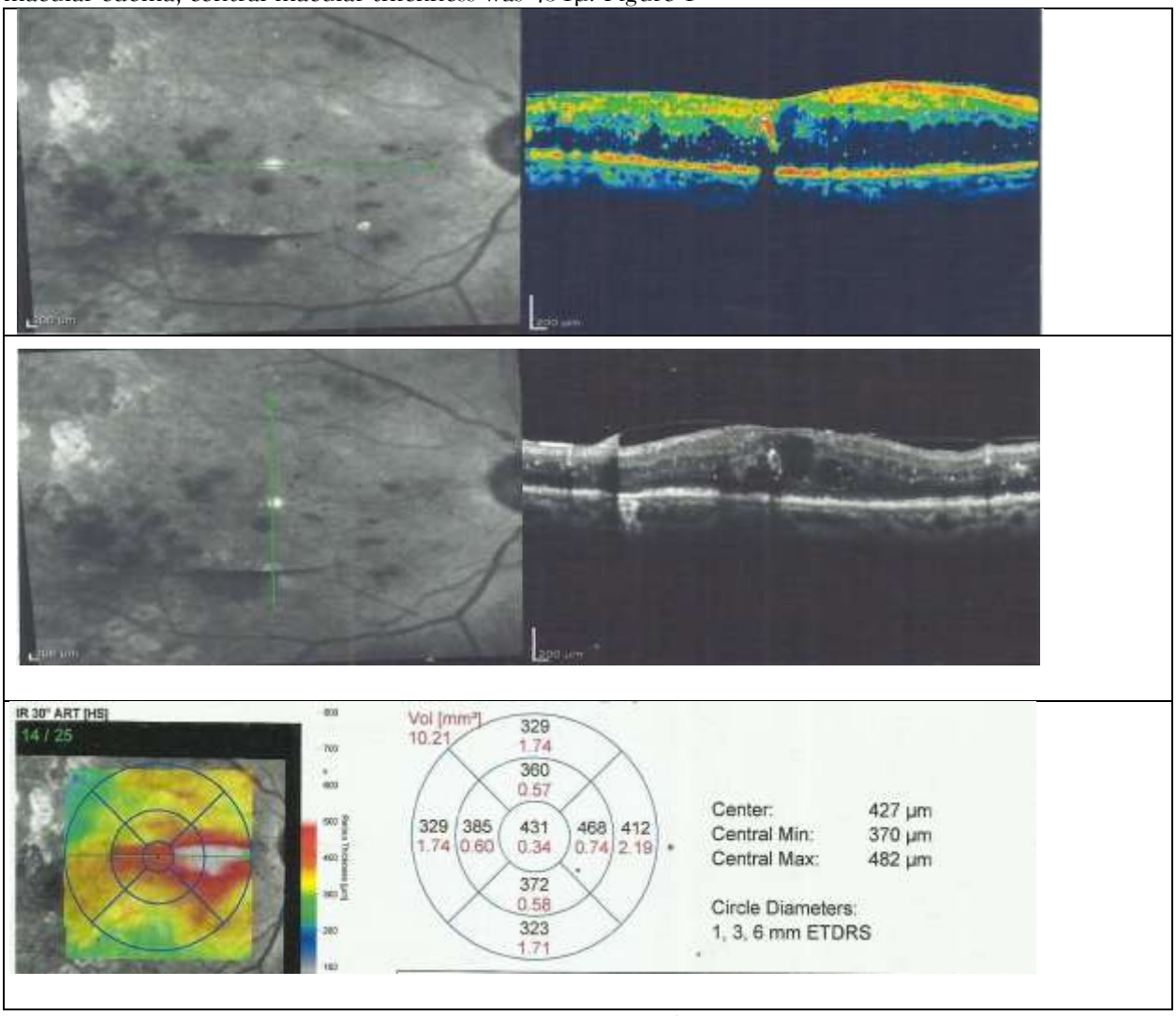
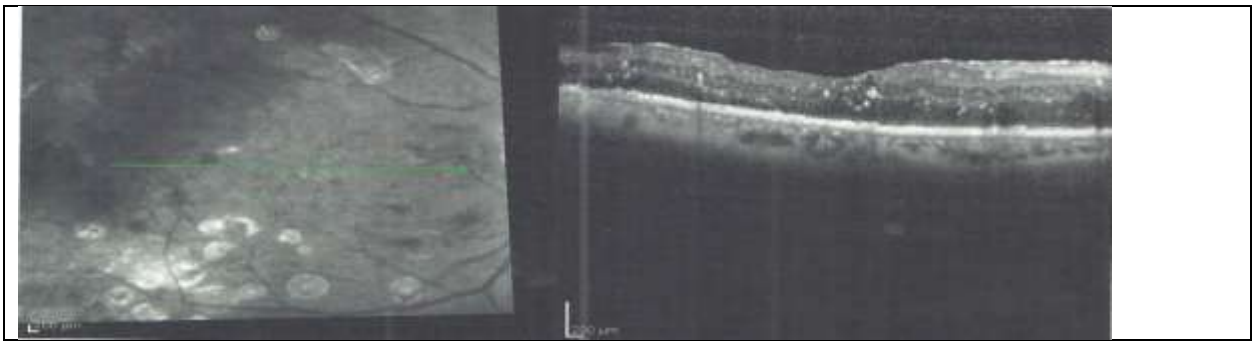


Fig. (1): Preoperative OCT of patient no.7.



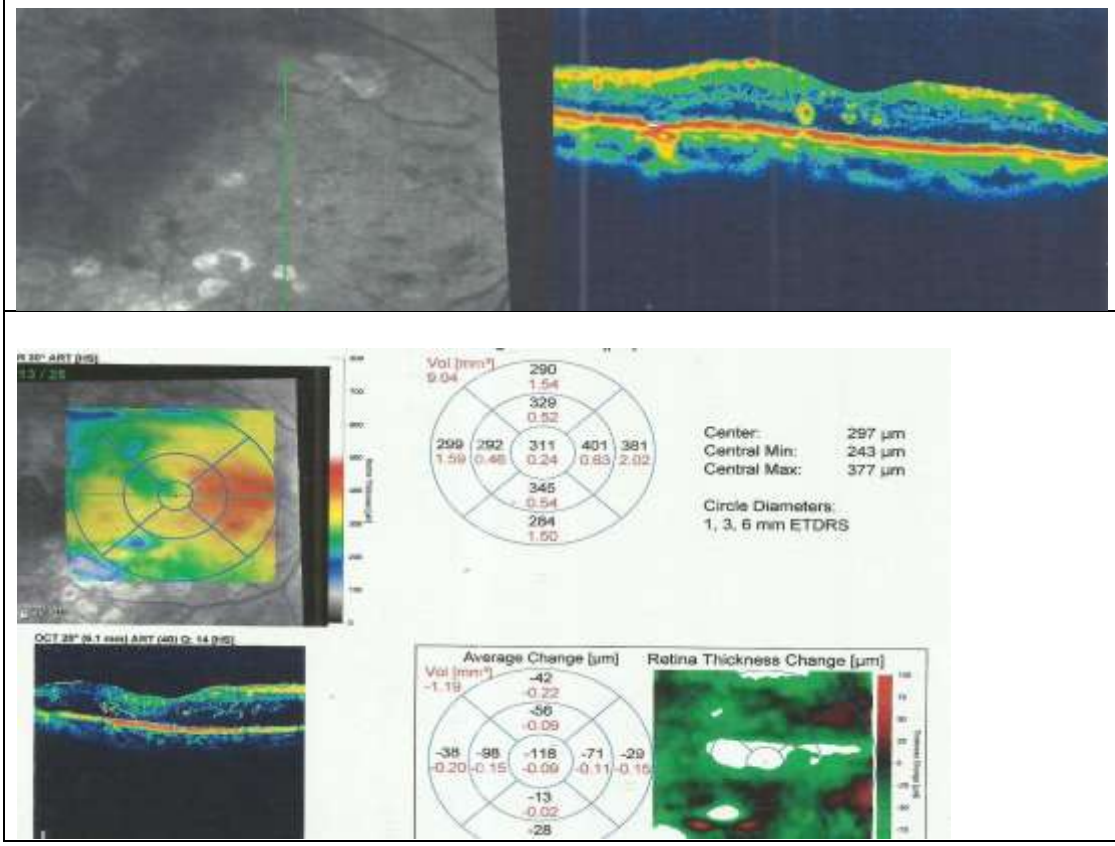
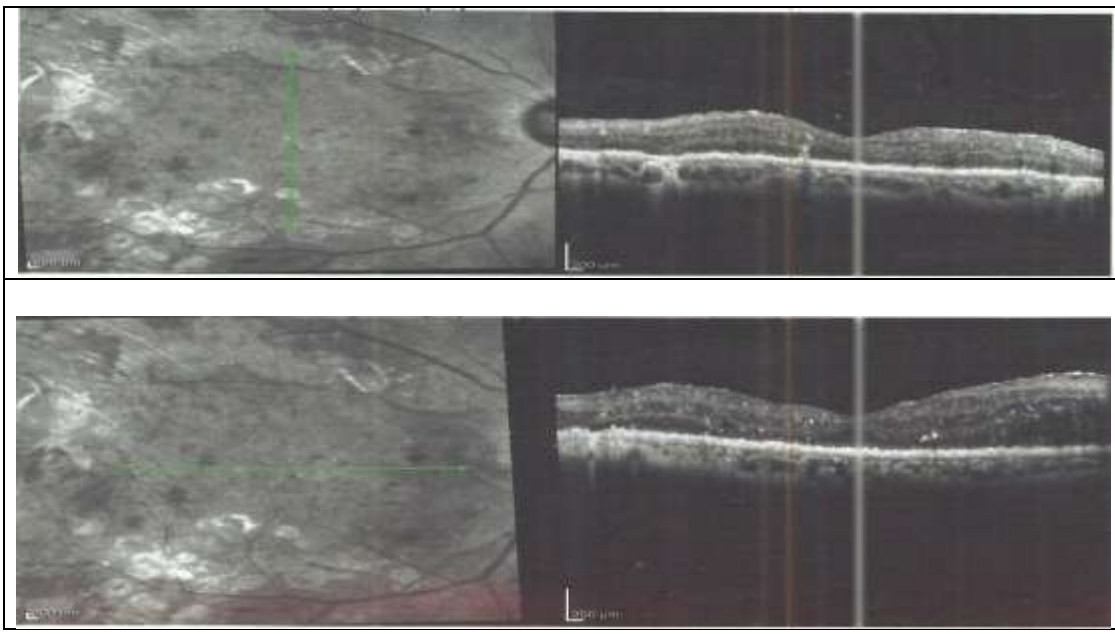


Figure (2): Postoperative OCT two months after surgery

In comparison to OCT done before surgery, there is regression in central macular thickness after vitrectomy 118µ with BCVA 0.6LogMAR (figure 2).



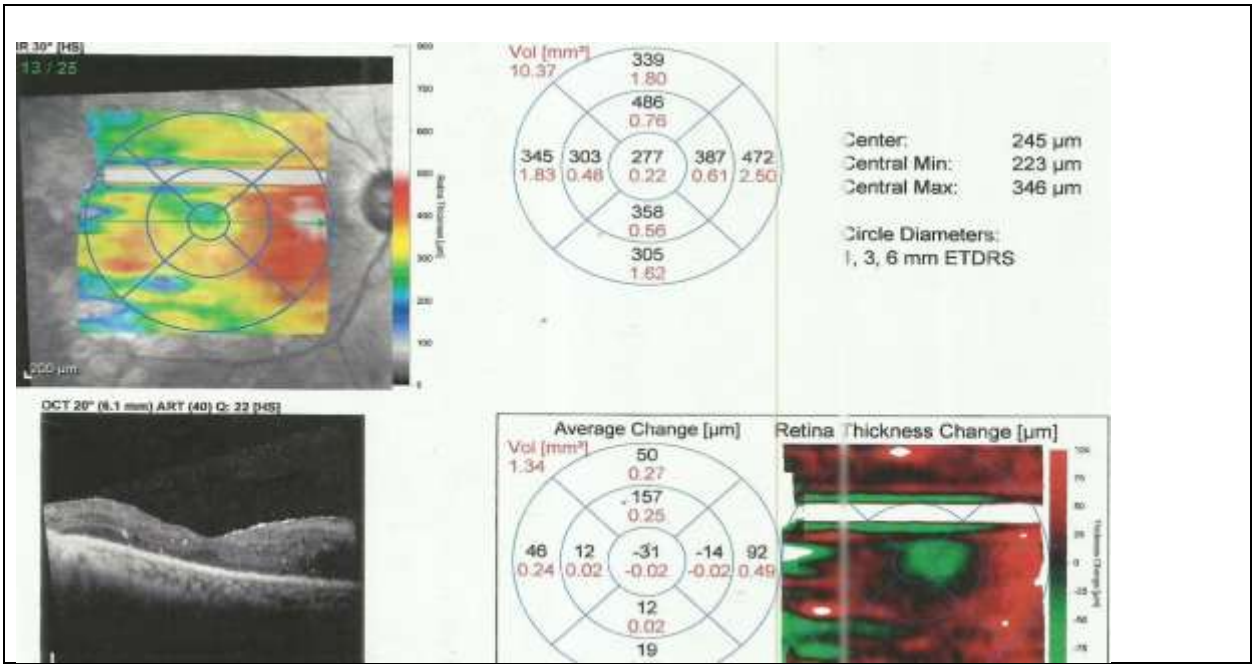


Figure (3): Postoperative OCT 6 months after surgery.

There is also regression in central macular thickness after six months of surgery of 31µ with no improving of BCVA 0.6LogMAR. Figure 3

Example 2

Patient no.28, A female patient 58 years old referred from medical retina clinic in RIO to our surgical retina clinic she presented with PDR in her Rt eye, best corrected vision was 1.0 LogMAR, OCT was done showing vitreo-macular traction with diffuse macular edema, central macular thickness was 507µ. Figure 4

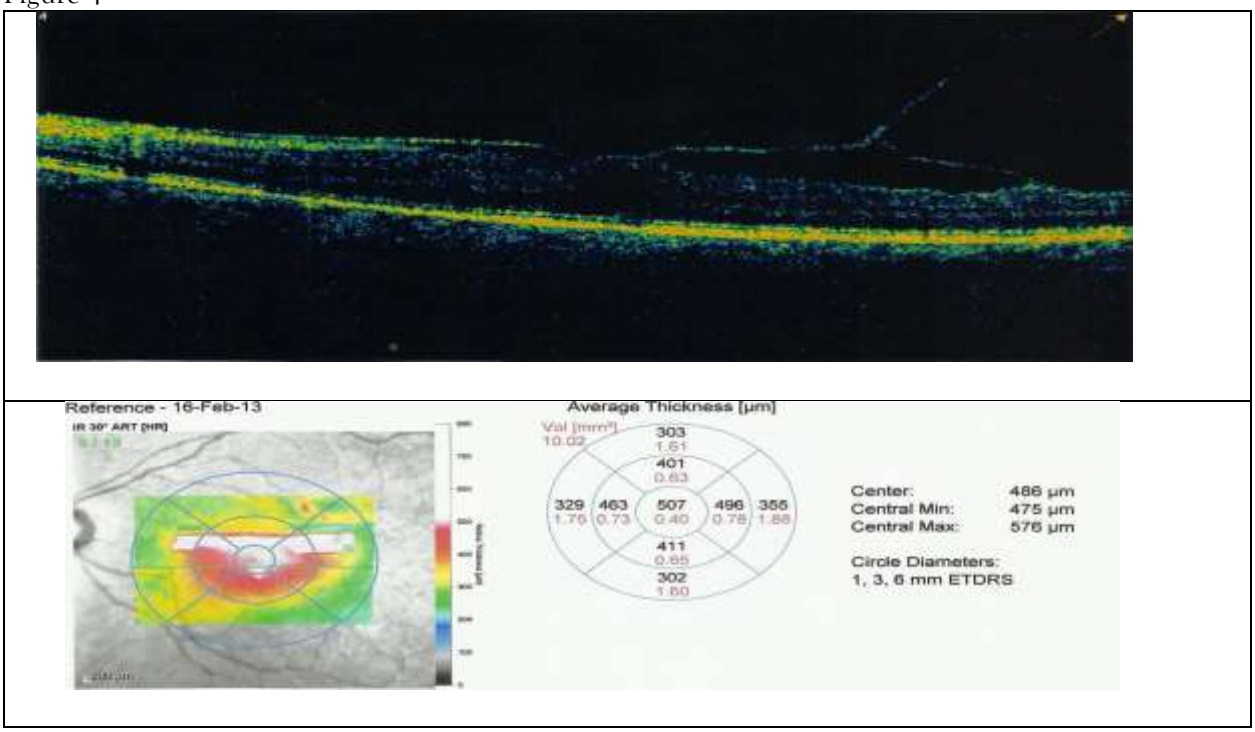


Figure (4): Preoperative OCT of patient no.28

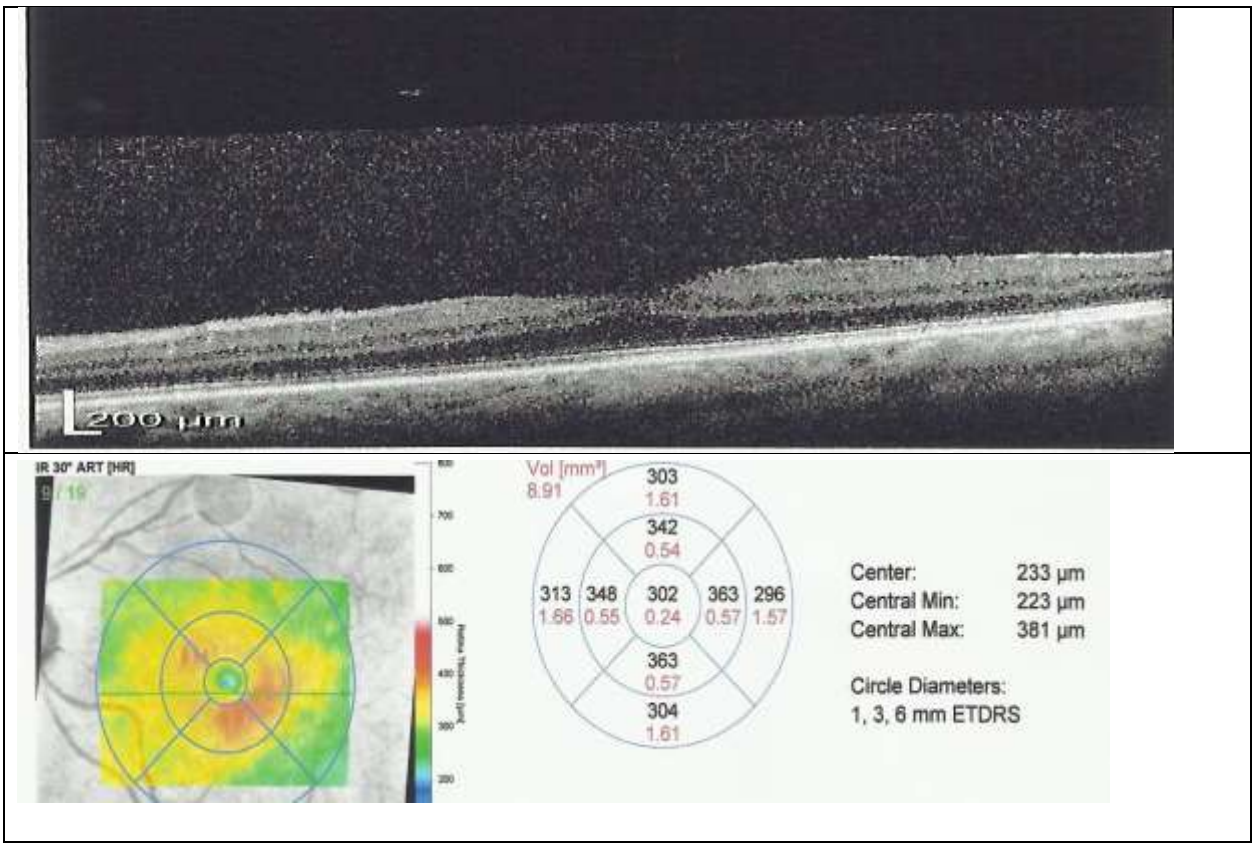


Figure (5): Postoperative OCT two months after surgery

In comparison to OCT done before surgery, there is regression in central macular thickness after vitrectomy 205µ with BCVA 0.7LogMAR. (Figure 5)

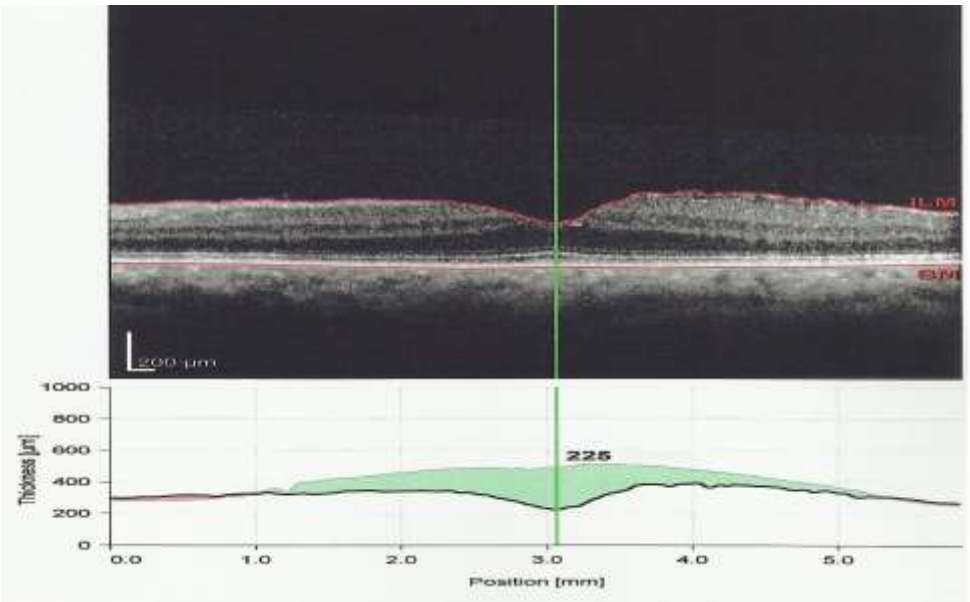


Figure (6): Postoperative OCT six months after surgery.

There is also regression in central macular thickness after six months of surgery of 77µ with no improving of BCVA 0.7LogMAR. Figure 6

4. DISCUSSION

The significance of vitreo-macular interface (VMI) anomalies in the diabetic retinopathy population is crucial, as it might affect disease development and therapy response. The liquefaction of the vitreous gel results in the weakening of adhesions at the vitreoretinal interface, leading to the collapse of the vitreous and it pulls away from the retina, this process referred to as PVD. Occasionally, vitreous liquefaction exceeds vitreoretinal dehiscence, leading to abnormal posterior vitreous detachment. When the vitreous is only partially detached at the macula with normal anatomy, it is referred to as vitreomacular adhesion (VMA); if it results in anatomical retinal alternations on OCT, it is termed vitreomacular traction (VMT) (7).

This retrospective research of the result of 23 guage vitrectomy in 48eyes with PDR and VMT showed positive results, with BCVA was improved from baseline to six months in (23%) and worsening in (16%). Diminution in OCT central macular thickness more than 50 microns occurred in 66%, and more than 100 microns occurred in 20%. As expected, eyes exhibiting higher baseline retinal thickness observed a higher reduction in retinal thickness after operation.

At six months, the median OCT CMT diminished by 160 microns, with forty-three percent exhibiting a central subfield thickness of less than 250 microns and sixty-eight percent demonstrating a minimum a fifty percent decrease in thickening (in our study reduction of CMT more than 50 microns occur in 32 eyes (66%), reduction of CMT more than 100 micron occur in 10 eyes (20%), reduction of CMT less than 50

micron occur in 9 eyes (18%), increase CMT occur in 7 eyes 14%). At six months, Visual acuity enhanced by ten or more letters in thirty-eight percent and worsened by ten or more letters in twenty-two percent (in our study BCVA was improved in 12 eyes (25%), 5 of these eyes (10%) improved 2 lines, 5 of them improved 1 line (10%), 2 of them improved 3 lines. BCVA decreased in 8 eyes (16%), 5 eyes of them decreased 3 lines, 2 eyes decreased 6 lines and one decreased one line. 28 eyes (58%) show no change in BCVA) (8).

The DRCR group in their prospective study in 2010 had nearly similar results to ours; from total of eighty-seven eyes having vitrectomy for DME related to as a minimum moderate loss of vision and investigator-determined vitreomacular traction and refractory DME it concluded that after vitrectomy carried out for diabetic macular edema and vitreomacular traction, retinal thickening has been diminished in most eyes. Between twenty-eight and forty-nine percent of eyes were likely to have enhancement of visual acuity (compared to twenty-two percent of eyes had experienced an enhancement of 2 or more line from baseline at 2 months. At six months thirty-eight percent of eyes were improved by 2 or more line in our study), whereas between 13% and 31% were likely to have worsening (compared to 23% of the eyes had worsened 2 or more line from baseline, at 6 months and 22% had worsened by 2 or more line in our study)., improvement in 38% at 6 months and worsening in 22%. Most eyes had a diminution of thickening of a minimum fifty percent. Also, they found that eyes exhibiting higher retinal thickness at baseline tended to have higher decrease in retinal thickness after operation, possibly indicating a floor influence on the extent of thickness diminution appear when the macula is only mildly thickened. Minimal variations in outcomes have been observed between six months and one year, although the application of further procedures for DME management in twenty subjects and cataract operations in twelve subjects (9).

Only 2 preoperative factors have been identified as correlating with a poor visual result: 1) macular ischemia, which exhibited the strongest prediction. 2) Preoperative visual acuity of not more than one LogMAR.

To our information, the macular perfusion state wasn't earlier examined as a predictive factor for the visual result of vitrectomy in eyes had diabetic VMT. Our results of a strong correlation among poor visual and poor macular perfusion result isn't surprising, given the direct negative influence of ischemia on the inner retinal layers, which results in defective transmission of the visual signal among photoreceptors and optic nerve fibers. Though foveal and outer retinal oxygenation in the macula might enhance, inner macular perfusion isn't expected to change by macular reattachment operation; consequently, the poor visual result noted in these cases in our investigation. Assessing ischemia and

macular perfusion can be hard without conducting ancillary tests like fluorescein angiography. Nevertheless, our experience demonstrates that in cases of extensive tractional fibrovascular proliferation with VMT, a meaningful angiogram is most impossible to carry out. Regarding, the majority of our data about the macular perfusion state has been gained from the surgeon's pre-or-intraoperative evaluation of the macular vasculature (10).

Comparable to our result, other authors have stated an association among poor visual acuity following operation and less successful visual result. This is likely because eyes with poor baseline vision might be a subgroup of eyes with more chronic and advanced illness, exhibiting raised degree, complexity, and chronicity of VMT, following greater probability of intra- and postoperative complications. Otherwise, eyes had poor vision at baseline might include irreversibly compromised outer retina and photoreceptors, which restrict recovery of vision following operation (10).

La Heij et al. (11) stated that the age of fifty is a strong indicator of unfavorable visual result. This might possibly be clarified to a longer period of diabetes mellitus, worsened microvascular complications among older cases, and slow repair process in older diabetics.

Numerous researches have indicated that the lack of PRP before surgery and the existence of preoperative iris neovascularization correlate with a poorer visual prognosis because of the development of NVG postoperatively. We couldn't reproduce either of these results. This discrepancy might be explained as all eyes in our investigation had preoperative PRP. Conversely, the majority of the documented investigations date back to the era when endolaser and/or anti-vascular endothelial growth factor (VEGF) agents weren't assessable, thus not permitting the surgeons to control the active proliferative state of the illness promptly either preoperatively via anti-VEGF agents and/or intraoperatively via endolaser (11).

Prior researches indicate that visual enhancement or stabilization following vitrectomy for VMT ranged from fifty-seven to eighty-nine percent of eyes. Furthermore, twenty-two to seventy-two percent of eyes were documented to attain a visual acuity of 1.0 LogMAR or superior, with a final anatomic success rate ranging from sixty-four to ninety-three percent Knowing that reports dating back to 2003 might partially clarify our comparative results because of enhancement in operative methods and instruments over the past few years, like greater cut rates of vitrectomy machines, viewing systems and superior illumination, and the accessibility of staining material for the visualization of hyaloid, layers of vitreous schisis, and epiretinal membranes.

Abunajma et al. (12) in their retrospective study in 2016 of the outcomes of vitrectomy in ninety-six eyes hat VMT of above six months yielded positive outcomes, with 87.5 percent percent of those eyes exhibiting stable final visual acuity or an improvement of a minimum one line in comparison with their acuity prior to surgery, (in comparison with 83.3 percent in our research having stable final visual acuity or a gain of at a minimum one line in comparison with their visual acuity prior to surgery). This relatively successful visual outcome has been correlated with a good anatomical result, indicated by a 90.6 percent rate of retinal reattachment after a single procedure (compared to 85.4% in our study having good anatomical outcome).

Haller and Qin. (8) in their Prospective study to assess vitrectomy for diabetic macular edema in eyes with a minimum moderate vision loss and vitreomacular traction. It involved eighty-seven eyes with diabetic macular edema and vitreomacular traction, visual acuity 0.5–1.3LogMAR, (OCT) central macular thickness >300 microns and no concomitant cataract extraction at the period of vitrectomy. Monitoring visits have been carried out following three months, six months (1ry endpoint) and one year. At baseline, median visual acuity in the eighty-seven eyes was 0.7 LogMAR (compared to 1.0 LogMAR in our study) and median Optical Coherence Tomography thickness was 491 microns (compared to 474 microns in our study). Throughout vitrectomy, further procedures involved epiretinal membrane peeling in sixty-one percent, internal restricting membrane peeling in fifty-four percent, panretinal photocoagulation in forty percent, and corticosteroid injection at the close of the procedure in sixty-four percent.

5. CONCLUSION

Although information on patients' overall health was limited, this study shows that vitrectomy benefits eyes with chronic VMT, especially in younger patients with good baseline vision and non-ischemic macula. While longer VMT duration is linked to worse outcomes, the traditional view to avoid surgery after 6 months may not be entirely accurate, as most eyes still achieve useful vision post-surgery. Improved surgical techniques likely contributed to these better results, suggesting the need to revise existing recommendations.

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