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Macular Microstructure Assessment by Optical Coherence Tomography and Fundus Fluorescein Angiography before and after Silicone Oil Removal

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ABSTRACT

Background: since the early use, silicone oil (SO) has been used as long-term retinal endotamponade to manage complicated retinal diseases such as proliferative vitreoretinopathy, advanced proliferative diabetic retinopathy, and complex retinal detachment. A favorable anatomical success was reported after SO injection.

Objective: the aim of this study was to investigate the macular microstructural changes in eyes filled with silicone oil (SO) and course of these changes after SO removal, to determine the possible cause of unexplained visual loss by the use of optical coherence tomography and fundus fluorescein angiography.

Patients and Methods: This prospective observational study included a total of 40 eyes of 40 adult patients of both sexes with rhegmatogenous retinal detachment and scheduled for pars plana vitrectomy with silicone oil tamponade attending at ophthalmology outpatient clinic of Al-Azhar University Hospitals. This study was conducted between October 2015 to August 2018. **Results:** There were insignificant differences in visual prognosis between the group with persistent SRF and the group without. But VA bad prognosis can be explained through the other OCT finding not only the SRF. This confirm our conclusion of the importance of OCT examination after successful retinal detachment repair operation for VA prognosis prediction. In our study there was no difference between OCT finding before SOR and after, this means that duration of 3-month silicon oil tamponading is a safe duration.

Conclusion: Delayed or incomplete visual recovery after uncomplicated surgery for macula-off retinal detachment may be related not only to persistent subretinal fluid, but also to other pathological changes.

Keywords: Optical Coherence Tomography, Fundus Fluorescein Angiography, Silicone Oil

INTRODUCTION

Cibis *et al*. 1962 was the first to describe the use of silicone oil (SO) for the treatment of otherwise inoperable retinal detachments [(1)]. Since the early use, silicone oil (SO) has been used as long-term retinal endotamponade to manage complicated retinal diseases such as proliferative vitreoretinopathy, advanced proliferative diabetic retinopathy, and complex retinal detachment. A favorable anatomical success was reported after SO injection [(2)]. Prolonged silicone oil tamponade has been demonstrated to induce many complications, including cataract, glaucoma, keratopathy (mainly band shape keratopathy) and optic neuropathy associated with progressive visual deterioration. In addition, the microstructural retinal damages related to mechanical stress or biochemical toxicity, which called silicone retinopathy [(3)].

Therefore, some authors recommended the removal of the SO as soon as possible when a stable retina situation is achieved. Profound visual loss following SO use without any apparent explanation has been reported in a number of case series [(4)].

In 2004, the first case series of visual loss secondary to removal of silicone oil was published. This described seven patients who experienced sudden deterioration in central vision at the time of silicon removal, and for which no obvious cause could be determined. Visual acuity was frequently found to be 20/200 or worse. Since then, several other investigators have described case series of this phenomenon to occur both at the time of removal and while silicone oil is in situ [(3)]. The condition has been estimated to occur in up to 10% of silicone oil–filled eyes [(5)].

Many studies published have used time domain optical coherence tomography (OCT) soon after visual loss in these patients and have failed to detect any abnormalities in macular or optic disc architecture. Advances in OCT technology, particular with the advent of spectral domain imaging, permit significantly improved resolution now and have helped identify pathologic findings in a wide variety of both retinal and neurologic diseases [(6)]. The aim of this study was to investigate the macular microstructural changes in eyes filled with silicone oil (SO) and course of these changes after SO removal, to determine the possible cause of unexplained visual loss by the use of optical coherence tomography and fundus fluorescein angiography.

PATIENTS AND METHODS

This prospective observational study included a total of 40 eyes of 40 adult patients of both sexes with rhegmatogenous retinal detachment and scheduled for pars plana vitrectomy with silicone oil tamponade attending at ophthalmology outpatient clinic of Al-Azhar University Hospitals. **Approval of the research ethical committee and a written informed consent from all the subjects were obtained.** This study was conducted between October 2015 to August 2018. Macular was evaluated before and after SO removal. Silicone oil was removed when the eyes are confirmed to have attached retina after at least 3 months of SO tamponade.

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Inclusion criteria:

Patients underwent an uncomplicated pars plana vitrectomy with SO tamponade for rhegmatogenous RD, with known history of normal BCVA prior to RD . In addition the other eye has normal values for BCVA, OCT of the macula and FFA.

Exclusion criteria:

1. Opaque optical media, which significantly affects vision or disturbs the optical coherence tomography (OCT) image.
2. Postoperative complications after SO removal, which need second interventions including dense vitreous hemorrhage, recurrent retinal detachment, and aggravated proliferative vitreoretinopathy.
3. Complicated cases during SO tamponade with epiretinal membrane and recurrent RD.
4. Traction RD, vitreous hemorrhage and macular hole.
5. Known glaucoma patient, amblyopia or single eye .
6. Any retinal or optic nerve diseases.

Examinations: Full ophthalmic examination was performed 1and 3 months before SO removal and at months 1, 3 and 6 after removal including:

- Best-corrected visual acuity (BCVA) was measured using a Snellen chart.
- Intraocular pressure measurement was measured by applanation tonometry.
- Evaluation of anterior segment by slit lamp.
- Dilated fundoscopy will be performed using indirect ophthalmoscope and stereoscopic biomicroscopy with a noncontact +90 or + 78 diopter lens.

Investigations:

1. Optical coherence tomography (OCT) by OPTO machine was performed at 1 month after SO injection and before SO removal and at 1 and 3 months after SO removal.
2. Fundus fluorescein angiography (FFA) by TOPCON machine was performed before SO removal and at 1 month after. Retinal features, such as macular epiretinal membrane (ERM), cystoid macular edema (CMO), submacular fluid, photoreceptor inner segment/outer segment (IS/OS) junction, foveal avascular zone (FAZ), macular leakage and macular ischemia evaluated by OCT and FFA .

The macular ERM was defined as a hyper reflective line on the retinal surface involving the macula. Cystoid macular edema was defined as retinal thickening with loss of foveal depression with intraretinal cystoid change. Submacular fluid was defined as subclinical subretinal fluid involving the macula, which was unidentifiable by ophthalmoscope.

Statistical Methods

Analysis of data was performed using SPSS v. 25 (Statistical Package for Scientific Studies) for Windows & MedCalc v. 18

Description of variables was presented as follows:

- Description of quantitative variables was in the form of mean, standard deviation (SD), minimum and maximum.
- Description of qualitative variables was in the form of numbers (No.) and percent (%).

Data were explored for normality using Kolmogorov-Smirnov test of normality. The results of Kolmogorov-Smirnov test indicated that most of data were normally distributed (parametric data) so parametric tests were used for most of the comparisons.

- Comparison between quantitative variables was carried out by One-way analysis of variance (ANOVA) which was used to test the difference between the means of several subgroups of a variable (multiple testing). Student-newman-keuls test was used for all pairwise comparisons between groups.
- Odds ratio (OR): is used to compare the relative odds of the occurrence of the outcome of interest and results are graphed by Forest plot. 95% confidence interval (CI 95%) is used to estimate the precision of the OR.
- Binary correlation was carried out by Pearson correlation test. Results were expressed in the form of correlation coefficient (R) and P-values.
- The significance of the results was assessed in the form of P-value that was differentiated into:
  - Non-significant when P-value > 0.05
  - Significant when P-value ≤ 0.05
  - Highly significant when P-value ≤ 0.01

RESULTS

This study is a descriptive prospective study which was carried between October 2015 to August 2018 to assess the macular microstructure in silicone oil filled eyes during tamponade and after removal in 40 eyes of both sexes who were presented to ophthalmology outpatient clinic of Al-Azhar university hospital with rhegmatogenous retinal detachment with macula involvement and underwent successful retinal detachment repair with pars plana vitrectomy and silicone oil tamponade. These changes were studied during the presence of the oil in the eye (1 & 3 month post PPV + SOI) and after its removal (1&3&6 month post SOR**).** As shown in **Tables (1, 2)** the age range of the affected patients was **38 to 62** years (mean = **53.150 ± 5.14 years**) with male to female ratio **(30:10).**

Table (1): Age distribution in the study group (n= 40 cases)

Age (y)	Mean	SD	Range
Male	53.40	± 5.3666	38-62
Female	52.40	± 4.5753	44-57
All	53.150	± 5.1418	38-62

Table (2): Gender distribution in the study group (n=40 cases).

Gender	Male	Female
No.	30	10
%	75	25

As shown in Table (3, 4): The main risk factors in the patients of the study group were pseudophakia in 10 patients (25%), pseudophakia with high myopia in 2 patient (5%) and no identifiable risk factors in 28 patients (70 %).

Table (3): Risk factors for RD in the study group (n=40 cases)

	Count	%
pseudophakia	10	25%
myopia & pseudophakia	2	5%
No	28	70%

Table (4): Risk factors for RD in the study group

Risk factor	No.	%
Risk factor	12	30
No Risk factor	28	70

As shown in Table (5): Preoperative **BCVA** was significantly worse (hand motion with good projection) than sound eye, then after silicone oil filling and after silicone oil removal significantly improved but still significantly worse than sound eye (with significant difference between filling and removal).

Table (5): Comparing between filling BCVA and after silicone removal (SOR) in the study group by pairwise comparisons ANOVA test (n=40 cases)

BCVA (LogMar)			Mean difference	P.value	95% CI
Filling 1month	-	Filling 3month	0.0825	0.9966	-0.054 to 0.21
	-	SOR 1month	0.240	<0.0001	0.156 to 0.324
	-	SOR 3month	0.273	<0.0001	0.178 to 0.367
	-	SOR 6month	0.278	<0.0001	0.178 to 0.377
	-	Other eye	0.876	<0.0001	0.759 to 0.993
Filling 3month	-	SOR 1month	0.158	0.0008	0.049 to 0.266
	-	SOR 3month	0.190	<0.0001	0.086 to 0.294
	-	SOR 6month	0.195	<0.0001	0.086 to 0.304
	-	Other eye	0.794	<0.0001	0.670 to 0.917
SOR 1 month	-	SOR 3month	0.0325	0.2070	-0.006 to 0.07
	-	SOR 6month	0.0375	0.3022	-0.010to 0.085
	-	Other eye	0.636	<0.0001	0.533 to 0.739
SOR 3month	-	SOR 6month	0.00500	1.0000	-0.02 to 0.034
	-	Other eye	0.604	<0.0001	0.498 to 0.709
SOR 6month	-	Other eye	0.599	<0.0001	0.531 to 0.666

- There is statistically significant increase of mean filling BCVA (LogMAR) at 1month in comparison to mean BCVA (LogMAR) after SOR at 1month, 3month and 6month and also in comparison to other eye (P. < 0.05). clinically this mean BCVA was decreased at 1 month in comparison to BCVA after SOR at 1,3and 6 month.
- There is statistically significant increase of mean filling BCVA (LogMAR) at 3month in comparison to mean BCVA (LogMar) after SOR at 1month, 3month and 6month and also in comparison to other eye (P. < 0.05).
- There is statistically significant increase of mean BCVA (LogMar) after SOR at 1month in comparison to mean BCVA (LogMar) of other eye (P. < 0.05).
- There is statistically significant increase of mean BCVA (LogMar) after SOR at 3month in comparison to mean BCVA (LogMar) of other eye (P. < 0.05).
- There is statistically significant increase of mean BCVA (LogMar) after SOR at 6month in comparison to mean BCVA (LogMar) of other eye (P. < 0.05).

As shown in Table (6): Preoperative PPV **IOP** was significantly decrease (mean IOP 11.250 mmHg + or – 1.7537) than sound eye, then after silicone oil filling and after silicone oil removal significantly improved.

Table (6): Comparing between filling IOP and after silicon removal (SOR) in the study group by pairwise comparisons ANOVA test (n=40 cases)

IOP (mmHg)			Mean difference	P.value	95% CI
Before PPV	-	Filling 1month	-4.300	<0.0001	-5.30 to -3.298
	-	Filling 3month	-4.400	<0.0001	-5.49 to -3.303
	-	SOR 1month	-2.300	0.0001	-3.66 to -0.932
	-	SOR 3month	-3.750	<0.0001	-4.87 to -2.629
	-	SOR 6month	-3.950	<0.0001	-4.95 to -2.949
	-	Other eye	-4.950	<0.0001	-6.06 to -3.834
Filling 1month	-	Filling 3month	-0.100	1.0000	-1.029 to 0.829
	-	SOR 1month	2.000	<0.0001	1.013 to 2.987
	-	SOR 3month	0.550	1.0000	-0.381 to 1.481
	-	SOR 6month	0.350	1.0000	-0.517 to 1.217
	-	Other eye	-0.100	1.0000	-1.029 to 0.829
Filling 3month	-	SOR 1month	2.100	<0.0001	1.263 to 2.937
	-	SOR 3month	0.650	1.0000	-0.451 to 1.751
	-	SOR 6month	0.450	1.0000	-0.466 to 1.366
	-	Other eye	-0.550	1.0000	-1.641 to 0.541
SOR 1month	-	SOR 3month	-1.450	0.0008	-2.46 to -0.436
	-	SOR 6month	-1.650	<0.0001	-2.60 to -0.694
	-	Other eye	-2.650	<0.0001	-3.79 to -1.501
SOR 3month	-	SOR 6month	-0.200	1.0000	-0.929 to 0.529
		Other eye	-1.200	0.0004	-1.99 to -0.401
SOR 6month	-	Other eye	-1.000	0.0004	-1.52 to -0.478

- There is statistically significant decrease of mean IOP before PPV in comparison to mean IOP; filling 1month, filling 3month, SOR 1month, SOR 3month, SOR 6month, and also in comparison to other eye (P. < 0.05).
- There is statistically significant increase of mean filling IOP at 1month in comparison to mean IOP after SOR at 1month (P. < 0.05).
- There is statistically significant increase of mean filling IOP at 3month in comparison to mean IOP after SOR at 1month (P. < 0.05).
- There is statistically significant decrease of mean IOP after SOR at 1month in comparison to mean IOP; SOR 3month, SOR 6month, and also in comparison to other eye (P. < 0.05).
- There is statistically significant decrease of mean IOP after SOR at 3month in comparison to other eye (P. < 0.05).
- There is statistically significant decrease of mean IOP after SOR at 6month in comparison to other eye (P. < 0.05).

Table (7): IOP before PPV (correlation it with BCVA 6 month post SOR)

		CVA (logMar) SOR 3 month
IOP before PPV (mmHg)	**Correlation Coefficient**	-0.641-
	P value	< 0.001
	N	40

There is statistically significant positive correlation between IOP before PPV BCVA 6 month post SOR.

As shown in Table (8): OCT macular thickness in central circle (500 µm in diameter) was not significantly different between after silicone oil filling and after silicone oil removal**.**

Table (8): Comparing between filling OCT- CMT and after silicon removal (SOR) in the study group by pairwise comparisons ANOVA test (n=40 cases)

OCT- CMT			Mean difference	P.value	95% CI
Filling 1month	-	Filling 3month	2.050	0.5133	-0.984 to 5.084
	-	SOR 1month	-2.450	0.2520	-5.582 to 0.682
	-	SOR 3month	-2.650	0.1645	-5.795 to 0.495
	-	Other eye	-17.175	<0.0001	-23.57 to -10.8
Filling 3month	-	SOR 1month	-4.500	<0.0001	-6.09 to -2.902
	-	SOR 3month	-4.700	<0.0001	-6.62 to -2.779
	-	Other eye	-19.225	<0.0001	-24.7 to -13.75
SOR 1month	-	SOR 3month	-0.200	1.0000	-1.471 to 1.071
	-	Other eye	-14.725	<0.0001	-19.84 to -9.60
SOR 3month	-	Other eye	-14.525	<0.0001	-20.03 to -9.01

- There is statistically significant decrease of mean filling OCT-CMT at 1month in comparison to other eye (P. < 0.05).
- There is statistically significant decrease of mean filling OCT-CMT at 3month to mean OCT-CMT; SOR 1month, SOR 3month, and also in comparison to other eye (P. < 0.05).
- There is statistically significant decrease of mean OCT-CMT after SOR at 1month in comparison to the other eye (P. < 0.05).
- There is statistically significant decrease of mean OCT-CMT after SOR at 3month in comparison to the other eye (P. < 0.05).

Table (9): Relation between RD site and ocular measurments (IOP , BCVA, CMT) after silicone removal (SOR) by ANOVA test in the study group (n=40 cases)

SOR	Lower RD		Total RD		Upper RD		P.value
	Mean	SD	Mean	SD	Mean	SD	
BCVA 1 months (LogMar)	0.580	0.1033	0.772	0.2390	0.520	0.1095	0.010
BCVA 3 months (LogMar)	0.54	0.084	0.74	0.24	0.48	0.044	0.006
BCVA 6 months (LogMar)	0.54	0.084	0.740	0.23	0.46	0.054	0.003
IOP 1months (mmHg)	13.200	1.3984	13.760	1.4514	13.200	1.0954	0.482
IOP 3 months (mmHg)	14.80	1.39	15.20	1.15	14.40	0.89	0.337
IOP 6 months (mmHg)	15.40	0.96	15.20	1.15	14.80	1.09	0.616
OCT-CMT 1months	197.100	5.933	187.92	12.47	203.60	5.128	0.006
OCT-CMT 3 months	197.40	6.81	187.88	13.29	204.80	4.32	0.006

- There is statistically significant difference of mean BCVA after SOR 1months between different types of RD cases (P. < 0.05). The significant difference found by Student-Newman-Keuls test between Cases with total RD and both cases with lower and upper RD.
- There is statistically significant difference of mean BCVA after SOR 3months between different types of RD cases (P. < 0.05). The significant difference found by Student-Newman-Keuls test between Cases with total RD and both cases with lower and upper RD.
- There is statistically significant difference of mean BCVA after SOR 6months between different types of RD cases (P. < 0.05). The significant difference found by Student-Newman-Keuls test between Cases with total RD and both cases with lower and upper RD.
- There is statistically significant difference of mean OCT-CMT after SOR 1months between different types of RD cases (P. < 0.05). The significant difference found by Student-Newman-Keuls test between Cases with total RD and both cases with lower and upper RD.
- There is statistically significant difference of mean OCT-CMT after SOR 3months between different types of RD cases (P. < 0.05). The significant difference found by Student-Newman-Keuls test between Cases with total RD and both cases with lower and upper RD.

Table (10): Pearson correlation between BCVA and OCT-CMT in the study group (n=40 cases).

OCT-CMT	BCVA	
	Correlation (r)	P.value
Filling 1month	-0.2916	0.0679
Filling 3month	-0.5981	<0.0001
SOR 1month	-0.7682	<0.0001
SOR 3month	-0.8450	<0.0001

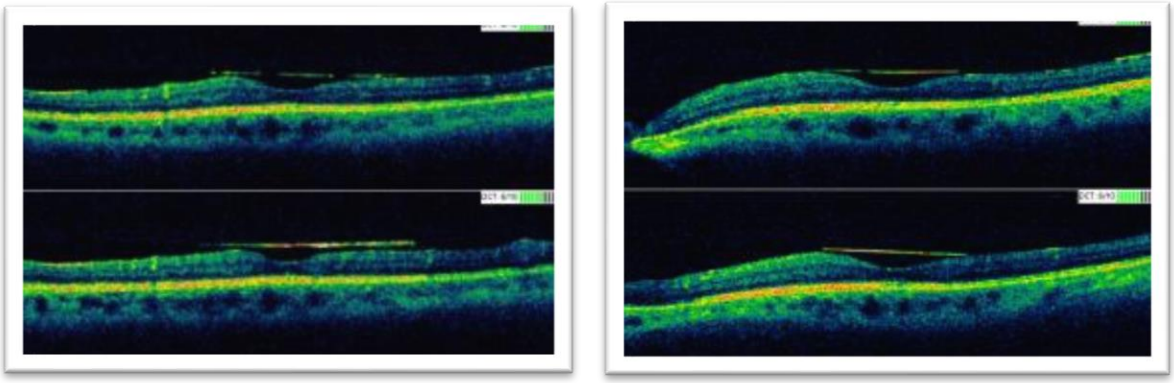
- There is statistically significant negative correlation between filling BCVA at 3month and filling OCT-CMT at 3month (r= -0.598, P.<0.05).
- There is statistically significant negative correlation between BCVA after SOR 1month and OCT-CMT after SOR 1month (r= -0.768, P.<0.05).
- There is statistically significant negative correlation between BCVA after SOR 3month and OCT-CMT after SOR at 3month (r= -0.845, P.<0.05).

Table (11): Pearson correlation between filling BCVA and SOR BCVA in the study group (n=40 cases).

Filling BCVA	SOR BCVA	
	Correlation (r)	P.value
1month	0.7540	<0.0001
3month	0.6302	<0.0001

- There is statistically significant positive correlation between filling BCVA at 1month and BCVA after SOR 1month (r= 0.7540, P.<0.05).
- There is statistically significant positive correlation between filling BCVA at 3month and BCVA after SOR 3month (r= 0.6302, P.<0.05).

A B



C D

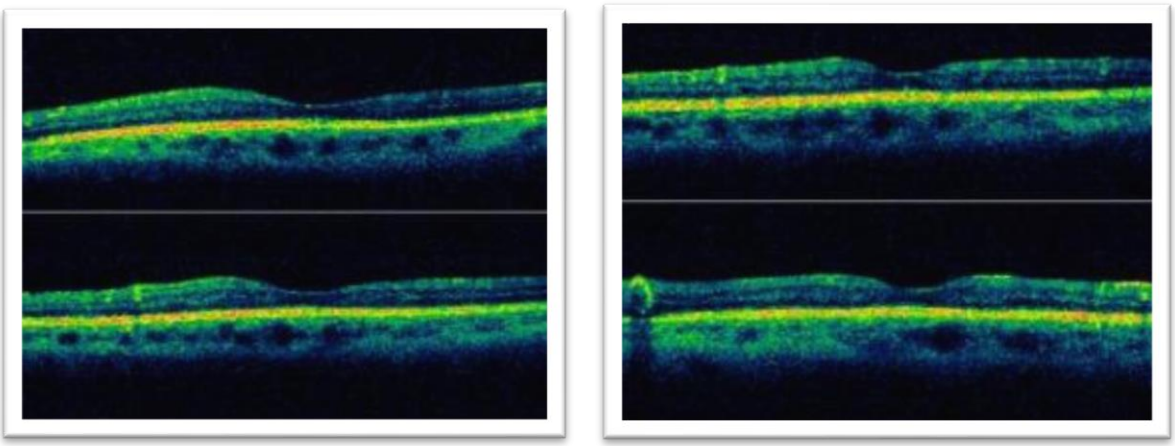
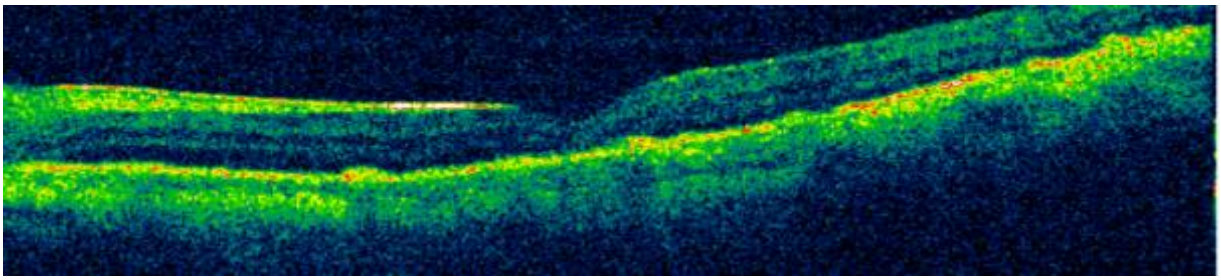


Figure (1):
Patient Number 18
A, B reveal foveal thinning during silicone tamponade. *C, D* reveal no finding changes after SOR

A



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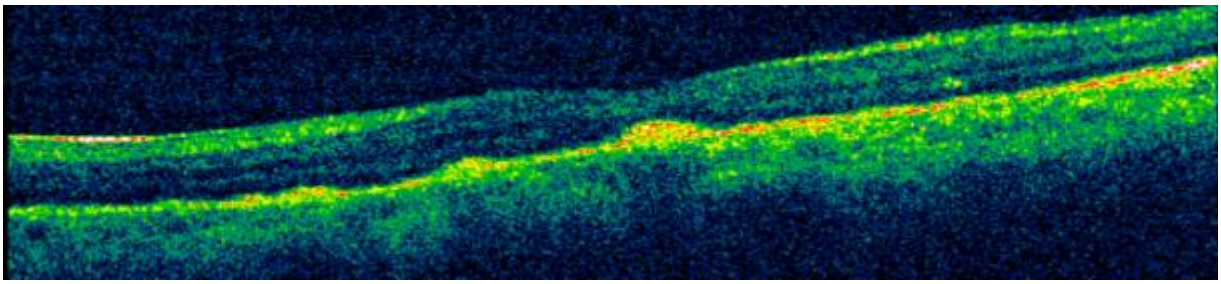

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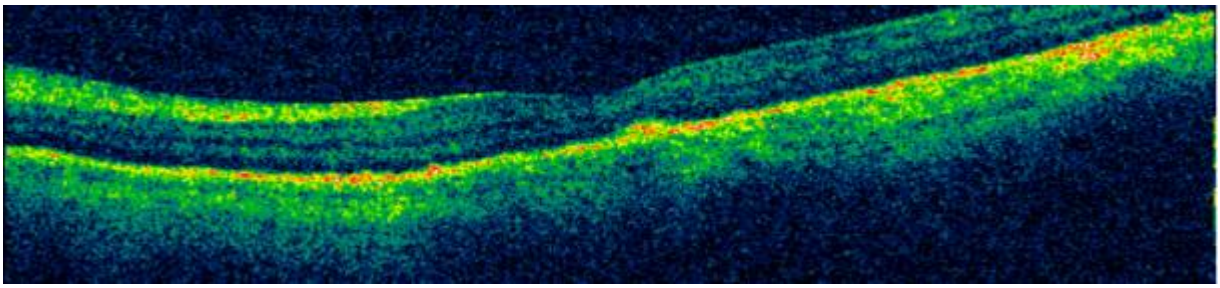

D

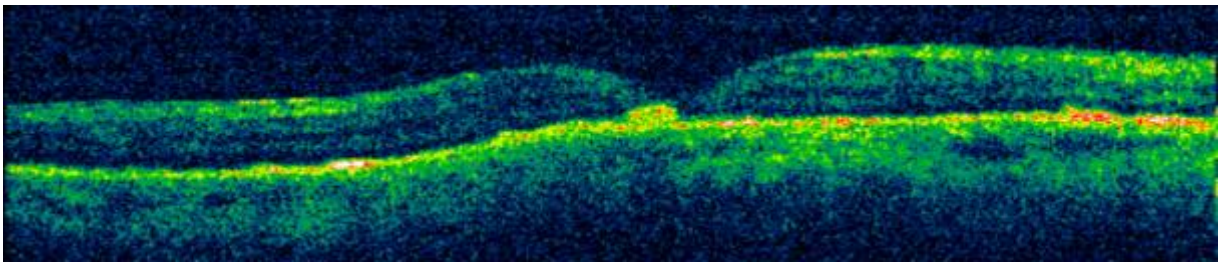

Figure (2):
Patient Number 8
A, *B* reveal IS / OS disruption during silicone tamponade. *C*, *D* reveal no finding changes after SOR

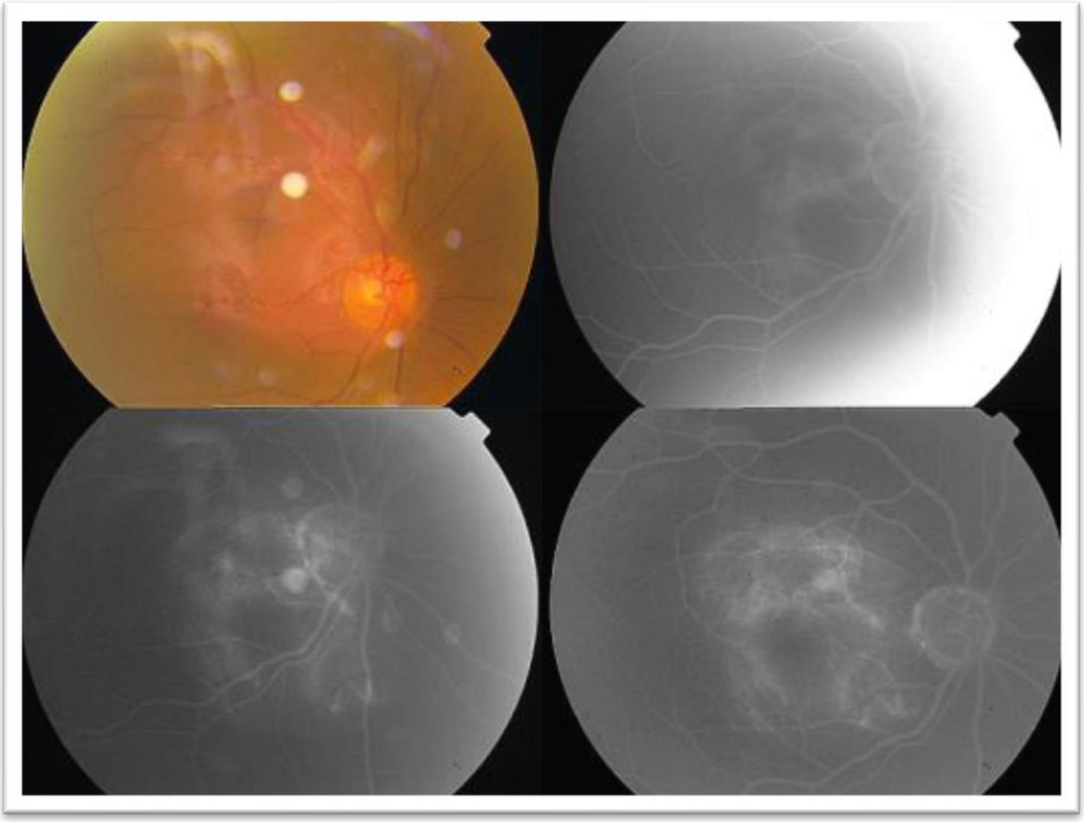

Figure (3): Patient number 8 FFA during silicone tamponade show silicone reflection with no affection of FAZ size or macular perfusion .

DISCUSSION

In our prospective observational case study, we assessed macular microstructural in silicone oil filled eyes, course of these changes after SO removal and their relationship with BCVA. These changes were evaluated in 40 eyes of 40 patients of both sexes who were presented to ophthalmology outpatient clinic of AL-Hussin university hospitals with rhegmatogenous retinal detachment with recent history of drop of vision (less than one week). They were underwent successful retinal detachment repair with pars plana vitrectomy and silicone oil tamponade then they underwent silicon oil removal after 3 months. These changes were studied during the presence of the oil in the eye (1 month and 3 months postoperatively) and after its removal (1 month and 3 month postoperatively).

Avitabile *et al.* [7] assessed prospectively the features of the macular surface in silicone oil–filled eyes after surgery by analyzing whether silicone oil affects optical coherence tomography (OCT) measurements and their reproducibility. They found no statistically significant differences between the measurements before and after silicone oil removal (z = -525; P = 0.599). Therefore, the presence of silicone oil in the vitreous chamber did not affect the reliability of measurements by OCT.

Ross and Kozy [8] performed a non-controlled, prospective, interventional case series on 104 patients with macula-off detachments of 7 days or less. Patients were grouped into three groups; those operated on between 1 and 2 days, 3 and 4 days, or 5 and 7 days after macular involvement. There was no statistical difference in visual recovery in patients operated on within 1 to 2 days, 3 to 4 days, or 5 to 7 days after macular involvement (P = 0.533). They concluded that macula-off detachments can therefore be treated with less urgency and can wait for the next scheduled available operating room time.

Based on the results of the previous studies, the exclusion criteria in our study included all patients with rhegmatogenous retinal detachment for longer than 7 days.

As clinical examination alone may fail to reveal the presence of foveal detachment, **Gibran and Cleary** [9] suggested that OCT is the tool of choice in investigating the delayed postoperative visual recovery.

Regarding Patients' Risk factors**:** In the current study results showed that the main risk factors for rhegmatogenous RD in the patients of the study group were pseudophakia in 9 patients **(22.5 %)**, myopia in 1 patient **(2.5 %)**,myopia with pseudophakia in 1 patient **(2.5 %)** with no identifiable risk factors in 29 patients **(72.5 %) .**

Regarding V/A assessment: BCVA (LogMAR units):

Our study was aimed to investigate the macular microstructural changes in eyes filled

with silicone oil (SO) and course of these changes after SO removal, to determine the possible cause of unexplained visual loss .

In the current study, preoperative BCVA was significantly worse than other eye, then after silicone oil filling and after silicone oil removal significantly improved (with significant difference between filling and removal), but still significantly worse than other eye which could be attributed to the following possible etiology.

All of the patients in the current study had macula off RD which could affect the visual recovery after anatomically successful RD surgery. This could be explained, as **Ross** [(10)] who reported that even with the modern surgical techniques to repair RD with a high level of anatomical success, the visual results remained compromised mainly because of permanent functional damage once the macula becomes detached.

In our study 18 cases (45% of all cases) achieved vision of 0.5 LogMar (= 6/18) and 12 cases (30 % of all cases) achived vision of 0.7 LogMar (= 6/30) in sixth month post SOR.

Studies of visual recovery after macula-off retinal detachment have shown that 37–71% of patients with primary reattachment achieve 6/12 or better [(11)].

Brinton and Wilkinson [(12)] also reported that the outcome of surgically treated RD should take into account the evaluation of both anatomic success (retina re-attachment) and functional success (visual acuity recovery). With modern techniques, anatomic success occured in more than 90% of cases with one or multiple operations. However, if the detachment includes the macular region, despite a good postoperative anatomical result, the possibility of a correct functional recovery was less than 40 %.

In the current study**,** the BCVA was evaluated 1 month and 3 month postoperatively then after removal of the silicone oil (1, 3 and 6 month postoperatively). Although most patients who undergo retinal detachment surgery have stable vision 3–6 months after surgery.

Vision continues to improve in a subgroup of patients up to 5 years after surgery [(10)].

In the current study**,** cystoid macular oedema, occurred in 1 patient (2.5%) , IS / OS disruption occurred in 4 patients (10 %), foveal thining in 3 patient (7.5 %), and residual subretinal fluid in 3 patients (7.5%) which could affect the visual recovery in those patients subgroup even after anatomically successful RD surgery. We noted significant relation between this OCT macular findings and drop of BCVA during silicon filling and after removal .

It has been known for many decades that several macular abnormalities, such as cystoid macular oedema, epiretinal membrane formation, retinal folds and pigment migration, can occur after successful surgery for RD [(13)]**.** Cystoid macular oedema appears to be one of the most frequent postoperative macular complication which influence macular recovery negatively after RD surgery [(14, 15)]**.**

Benson *et al.* [(16)] performed a study for one hundered patient to define the incidence, duration, and clinical associations of persistent localized submacular fluid after pars plana vitrectomy (PPV) retinal detachment surgery. Of the one hundred patients 15 had SRF on OCT performed at 6 weeks after surgery. Subretinal fluid was associated with significantly worse visual acuity (VA) at 6 weeks (P = 0.033, Wilcoxon rank-sum); those with SRF had a median VA of 0.4, and those with no SRF had a median VA of 0.3. The fluid took a median of 5.5 months to resolve.

In our study, we included 40 cases with acute retinal detachment with macula-off. All patients underwent uneventful PPV+Silicone. SRF was detected in 3 cases (7.5%). The visual acuity for those cases was 1.3 after 1 month postoperatively. Two cases showed an improvement of vision with decrease of the amount of SRF over time achieving BCVA 0.5 LogMar . the third case acvived less improvement to 1 LogMar after decrease of the amount of SRF over time , we detected in third case Photoreceptor disruptions as another cause for bad vision prognosis .

So, In our study, the persistent SRF group of cases showed an improvement of vision with decrease of the amount of SRF over time.

In our study all of the 40 cases had macula-off retinal detachment and the follow up was for 6 months post SOR. The mean visual acuity in our study was 0.655 LogMar (20/70) in sixth month post SOR examination, but in **Wakabayashi *et al.*** [(17)] study the mean visual acuity was (20/36) in 10 months postoperatively, this difference could be attributed to post-operative less duration follow up in compare with Wakabayashi's study.

In our study persistent subretinal fluid (SRF) after 1 months was detected in only 3 cases (3/40), while in Wakabayashi's study they detected persistent subretinal fluid in 6 cases (6/38).

According to OCT finding, we confirm the conclusion of Wakabayashi's study that after anatomically successful RRD repair, SD-OCT is a valuable, noninvasive tool for evaluating foveal microstructural changes.

OCT macular thickness in central circle:

OCT macular thickness in central circle (500 µm in diameter) was not significantly different between after silicone oil filling and after silicone oil removal.

The results of the current study were not in agreement with **Caramoy *et al.*** [(18)] who studied the OCT of nine patients with silicone oil-based endotamponade with no macular condition interfering with retinal layers measurements. These patients had retinal detachment not involving the macula due to various conditions. They noticed that Ganglion cell and inner retinal layers

become subsequently thinner after the use of silicone oil-based endotamponade.

This disagreement could be attributed to their main exclusion criteria of retinal detachment involving macula; while all of the current study patients had macular detachment.In our study we did FFA during silicone filling and after removal to assess and document macular perfusion, but we didn't find any changes at FFA or relation to drop of BCVA during study, this means FFA has limited value.

CONCLUSION

It could be concluded that delayed or incomplete visual recovery after uncomplicated surgery for macula-off retinal detachment may be related not only to persistent subretinal fluid, but also to other pathological changes. OCT play an important role in postoperative macular changes assessment, that are not visible ophthalmoscopically.

SD-OCT is an irreplaceable instrument for the postoperative assessment of macula in patients who have undergone surgery for macula-off RRD. It permits detection of the presence of foveal changes that are not visible with ophthalmoscope. Persistent sub-retinal fluid is responsible for the poor prognosis after surgery. Although there are a detectable improvement in vision with decrease of the amount of subretinal fluid, Vision prognosis relates also to other pathological finding as Photoreceptors integrity, and presence or absence of CMO.

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