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Structure and Macular Sensitivity Characteristic After Silicone Oil Removal in Primary Rhegmatogenous Retinal Detachment

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ABSTRACT
Introduction: *Silicone oil (SO) is an endotamponade to manage several retinal detachments.The emulsification of silicone oil is one of the complications that may occur in several patients. Retinal macular changes may occur even with successful tamponade.*
Purpose: *to describethe structure and macular sensitivity characteristic after silicone oil removal in primary rhegmatogenous retinal detachment (RRD).*
Methods: *a prospective, descriptive case series study of who underwent SO tamponade for primary RRD. Optical coherence tomography (OCT) and microperimetry (MP-3) were conducted before SO removal and one week after SO removal.*
Result: *There were nine eyes that met the criteria. The mean age of the patients was 53.3±14 years. Most of the patients use silicon 1300 (66.67%) and under six months (77.8%) duration of silicone tamponade. After silicone oil removal, mean macular sensitivity in the central fovea decreased from 12.44 dB to 12.11 dB, and parafovea increased from 18.33 dB to 19.00 dB.The mean macular thickness in the fovea decreased from 269.89µm to 260µm. The mean macular thickness in parafovea was an increase from 316.16 to 328.00µm*
Conclusion: *There was an increase in macular sensitivity and thickness at parafovea after one-week silicone oil removal in primary rhegmatogenous retinal detachment.*
Keywords: *macular thickness, macular sensitivity, rhegmatogenous retinal detachment, silicone oil removal.*

INTRODUCTION

Silicone oil (SO) tamponade is an endotamponade to manage retinal diseases such as rhegmatogenous retinal detachment (RRD), complicated tractional retinal detachment, proliferative vitreoretinopathy, and severe traumatic retinal detachment. Gibis et al. reported the first use of silicone oil in vitreoretinal surgery in 1962. Silicone oil tamponade is often associated with complications such as cataracts, emulsification of silicone oil, glaucoma, corneal decompensation, and retinotoxic.[1,2]

The emulsification of silicone oil is a complication encountered in patients with silicone oil tamponade. Visual loss has been reported during the period of SO tamponade or at the time of its removal. Recommendation range from 3 months to 6 months for silicone oil removal to minimize these complications, although there is no definite optimal removal time.[3-5]

Retinal macular changes may occur even with successful tamponade. Optical coherence tomography (OCT) imaging for a precise mapping of the retinal structure due to high-resolution raster scanning. Microperimetry (MP-3) is a noninvasive measurement of local retinal sensitivity in the functional assessment of the retina. The exact manual. The exact manual of the retinal sensitivity map to morphological OCT data and the MP-3 enables the precise evaluation of treatment.[6–8]

The purpose ofthis study istodescribe the structural and macular sensitivity characteristic after silicone oil removal in primary rhegmatogenous retinal detachment.

MATERIAL AND METHODS

This is a prospective, descriptive case series study. The data of this study were taken from patients that had undergone silicone oil removal at Cicendo Eye Center National Eye Hospital in June 2022. Inclusion criteria were the patient's repaired RRD by pars plana vitrectomy (PPV) and SO tamponade, with a minimum follow-up of one week after silicone oil removal (SOR). The exclusion criteria were non-rhegmatogenous retinal detachment, traumatic retinal detachment, retinal re-detachment during SO removal, media opacity that made poor OCT image quality and MP3. All patients underwent full ophthalmological examination including uncorrected visual acuity (UCVA) using the logarithm of minimal angle of resolution (logMAR), intraocular pressure measurement using non-contact tonometry, Optical coherence tomography (OCT) and Microperimetry (MP-3) pre and one week post silicone oil removal.

Patient's baseline characteristics were recorded including age, sex, and duration of silicone oil, and diagnosis before pars plana vitrectomy with silicone oil tamponade. The microperimetry examination was performed using automatic fundus-related perimeter MP-3 (Nidek Technologies, Gamagori, Japan). Examination after pupil dilation with occlusion of the non-tested eye.The standardized stimulus grid consists of 33 stimulus grids overlying the central 12^o, Goldmann III stimulus size (white, 200ms), 4-2 threshold strategy, and red circle fixation target 1^o with white monochromatic luminance background at 31.4 asb. Retinal sensitivity was checked using the single response from the fovea centralis and four concentric rings of retina loci at 1^o, 2^o, 4^o, and 6^o from the center point. False-positive and false-negative rate MP-3 <15% was used in this study.

Optical coherence tomography examination was performed using a Stratus OCT scanner (Cirrus HD 5000; Carl Zeiss Media Meditech GmbH, Germany). The protocol scanning in this study used fast macular thickness, which produces retinal mapping consisting of 6 radiating cross-sectional scans. The early treatment diabetic retinopathy study (ETDRS) subfields were divided into two subgroups, the foveal central zone 1 mm, and parafoveal 3 mm. The recommended signal strength greater than five is an acceptable cut off for image quality.

Descriptive analysis was performed for the patient's baseline characteristics, macular thickness, and macular sensitivity one day before and seven days after surgery. All data were reported as mean.

RESULT

There were 28 eyes that underwent silicone oil removal during the period of June 2022. Four patients had re-detachment retinal when followed up one week after follow-up, eight patients lost to follow-up, and seven patients had opacity media. There were nine eyes of nine patients who met all the eligibility criteria. The mean age of the patients was 53.3 years old (±14). The sex distribution of the subjects was more in men than women. Visual acuity was increased after silicone oil removal from a mean of 1.5 LogMar to 1.2 LogMar. Intra-ocular pressure was decreased after silicone oil removal from 16.4 mmHg to 14.2 mmHg.

Table 1. ***Baseline characteristics***

Characteristic	n=9
Sex	
Male	6 (67%)
Female	3 (33%)
Age	
Mean	53.3 (±14)
Laterality	
Right	7 (78%)
Left	2 (22%)
Mean UCVA (LogMar)	
Before SOR	1.5 ± 0.23
After SOR	1.2 ± 0.19
Mean IOP (mmHg)	
Before SOR	16.4 ± 4.47
After SOR	14.2 ± 4.23

Our study divides the duration of silicone oil tamponade into < 6 months and ≥ 6 months.There were 7 (77,8%) patients had a duration ofsilicone oil tamponade under six months. The type of silicone oil used was 1300 and 5500. The most used type of silicone oil tamponade was 1300 with 6 (66.67%) patients.

Table 2. ***Duration and type of silicone oil tamponade***

Duration and type of SO	n=9
Duration	
<6 months	7
≥ 6 months	2
Silicone Oil	
1300	6
5500	3

Retinal thickness in macula has divide into fovea and parafovea. Mean macular thickness in fovea was decrease from 269.89µm to 260µm. Mean macular thickness in parafovea was increase from 316.16 to 328.00µm.

Table 3. ***Retinal thicknesschanges in the fovea and parafovea***

	Before SOR	1 week after SOR
Fovea	269.89 ± 50.61	260.33 ± 56.33
Parafovea	316.16 ± 41.84	328.00 ± 38.14

Fundus photographsthe exact location of macular sensitivity by color coding using MP-3 software. Mean macular sensitivity in the macula's central fovea decreased from 12.44 dB to 12.11 dB after silicone oil removal. Mean macular sensitivity in parafovea increased from 18.33 dB to 19.00 dB after silicone oil removal.

Table 4. ***Retinal sensitivity changes in the fovea and parafovea***

	Before SOR	One week after SOR
Fovea	12.44 ± 8.5	12.11 ± 8.19
Parafovea	18.33 ± 4.3	19.00 ± 3.82

DISCUSSION

The use of SO tamponade may affect retinal function and structure. In this study, we investigated the effect of silicone oil on the retina using OCT and MP-3 before and after SO removal.

Our study found that the retinal thickness at parafovea after SO removal had increased. Lee et al. showed that there was a significant difference in retinal thickness at parafovea between the groups before SO removal and one week after SO removal. Retinal thickness at the fovea, there was no significant difference between groups before SO removal and one week after SO removal. Our study found the same that there were no changes in retinal thickness at the fovea. Karasu et al. reported that there was no statistically significant change in macular thickness due to the SO tamponade period.[10,11]

Scheerlinek et al. said that MP-3 was a sensitive tool to demonstrate deep central scotoma in SO filled eyes. The study showed decreased median retinal sensitivity after SO tamponade compared to gas tamponade, but the study did not test retinal sensitivity using MP3 pre and post SO removal. Nagpal et al. said that

MP3 was a highly sensitive tool for detecting increased retinal sensitivity after SO removal. The improvement of retinal sensitivity following SO removal remains unclear. The complication of SO, such as cataracts, silicone oil emulsification, and secondary glaucoma, can affect vision and retinal sensitivity. In this study, mean macular sensitivity has increased in parafovea.[8,9]

Limitations of this study were a small number of cases included in the study, loss to follow-up, and the short duration of the study period. A cohort study with a head-to-head comparison of structural and functional retinal before and after silicone oil removal options would be the optimal study design for further investigations. There was no same operatorin our study.

CONCLUSION

There wasan increased retinal thickness and macular sensitivity at parafovea after one-week silicone oil removal in primary rhegmatogenous retinal detachment. Future studies are warranted to see the relationship between structure and retinal sensitivity after SO removal.

Conflict of Interest: There was no conflict of interest in this study

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