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Intraocular Silicone Oil Removed after 10 Years: A Case Report

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Abstract

Background: Silicone oil (SO) has been demonstrated with concrete efficacy and safety in the therapy of complex vitreoretinal diseases. SO is schemed to be cleared within several weeks or months after tamponade, but it's inevitable for permanent or residual SO in a fraction of patients under extremely complicated clinical conditions. Here, we presented a case of silicone oil removal after 10 years, mainly to observe the disadvantages of long-term persistence. **Case presentation:** A 69-year-old female with pathologic myopia denied trauma history who had undergone pars plana vitrectomy (PPV), retinal reattachment, laser, and silicone oil tamponade in 2012 presented to our hospital with eye pain and headache, no light perception of her right eye for six months. The slit-lamp biomicroscopy examination for OD indicated evident conjunctival congestion, new blood vessels invasion to the limbus, foggy edema of corneal epithelium, folds of Descemet's membrane and corneal endothelial edema. There were obvious emulsified silicone oil particles above the anterior chamber. *Goldmann's* applanation tonometry test revealed the intraocular pressure was as high as 45/17mmHg. From ocular ultrasound, we saw that the vitreous cavity was filled with silicone oil in right eye; as for the left eye, it showed marked axial elongation and posterior scleral staphyloma. We were unable to obtain more information from fundus photography and macular optical coherence tomography (OCT) due to edema of the cornea. After the silicone oil was removed successfully from her vitreous cavity, although there was no improvement in the patient's vision (no light perception), she was still satisfied with the relief from eye pain and headache benefited from the reduction of high intraocular pressure (Goldmann's intraocular pressure decreased to 19/14mmHg). **Conclusion:** Patients after PPV should remove silicone oil in time to avoid corneal damage, intraocular hypertension, lens opacity and retinal damage induced by long-term silicone tamponade.

Keywords

Silicone Oil, Long-Term Persistence, Emulsification, Silicone Retinopathy

1. Background

Silicone oil (SO) is one of the most appropriate endotamponade agents with numerous application in pars plana vitrectomy (PPV) with excellent characteristics of inertness optical transparency, as well as surface tension and high viscosity [1]. SO has demonstrated superiority in complicated courses including proliferative diabetic retinopathy, giant retinal tears, and heavy ocular trauma. It is generally recommended to remove SO after anatomical success since long-term residual SO in the vitreous cavity might generate various complications. Although the majority of these could be managed with drugs or subsequent surgeries, the risk for refractory secondary glaucoma and SO-related visual damage still exists and the underlying mechanism needs unravelling [2].

Herein, we report a case of silicone oil removal after 10 years, mainly to observe the disadvantages of long-term persistence.

2. Case Presentation

A 69-year-old female with pathologic myopia denied trauma history who had undergone pars plana vitrectomy (PPV), retinal reattachment, laser, and silicone oil tamponade in 2012 presented to our hospital with eye pain and headache, no light perception of her right eye for six months. The patient had a vision of 5/50 in OS (−8.50 DS/−0.75DC × 90˚). The slit-lamp biomicroscopy examination of OD revealed the patient had evident conjunctival congestion, new blood vessels invasion to the limbus, foggy edema of corneal epithelium, folds of Descemet's membrane and corneal endothelial edema. There were obvious emulsified silicone oil particles above the anterior chamber (**Figure 1(A)**). The intraocular pressure was as high as 45\17mmHg via *Goldmann's* applanation tonometry examination. From ocular ultrasound, it could be observed the vitreous cavity was filled with silicone oil (**Figure 1(C)**) and no more information from fundus photography and macular optical coherence tomography (OCT) due to edema of the cornea (**Figure 1(E)**, **Figure 1(G)**). For the patient's left eye, we saw a very obvious elongation of the axial length, posterior staphyloma, choroidal atrophy and myopic macular hole (**Figure 1(B)**, **Figure 1(D)**, **Figure 1(F)**, **Figure 1(H)**). She was completed with blood routine test, blood coagulation function and blood biochemistry. We can confirm that her general condition can withstand the operation. Two days later, we successfully removed the silicone oil from her vitreous cavity, although the patient's vision did not change, her ocular hypertension was relieved (19/14mmHg by *Goldmann's* applanation tonometry), and the patient's eye pain and headache were relieved. In addition, her conjunctival congestion was reduced, as was the degree of corneal haze and edema (**Figure 2(A)**, **Figure 2(B)**).

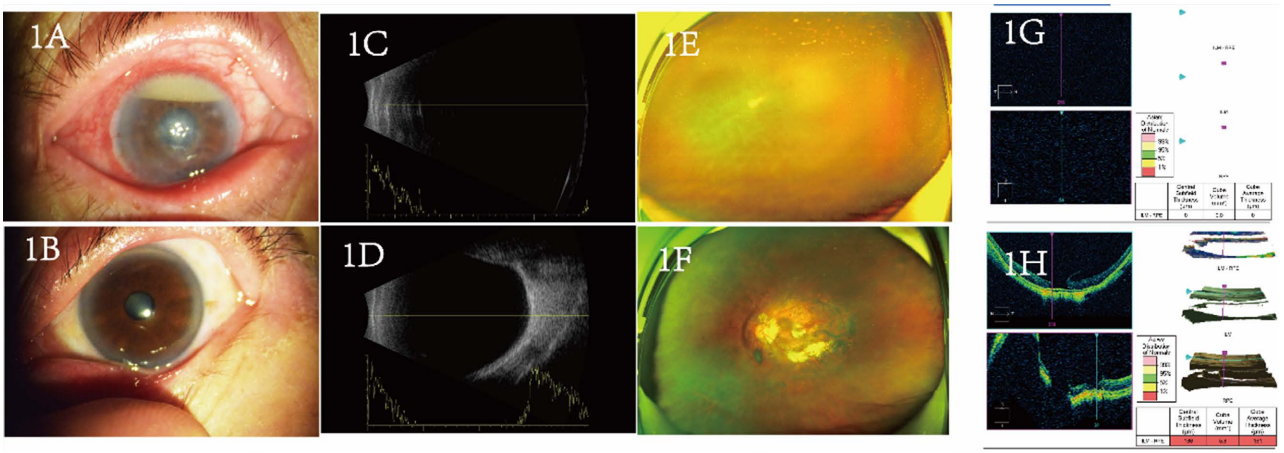

Figure 1. The patient underwent anterior segment photography, ocular ultrasound, fundus photography and macular OCT before silicone oil removal. (1(A), 1(C), 1(E), 1(G): right eye; 1(B), 1(D), 1(F), 1(H): left eye).

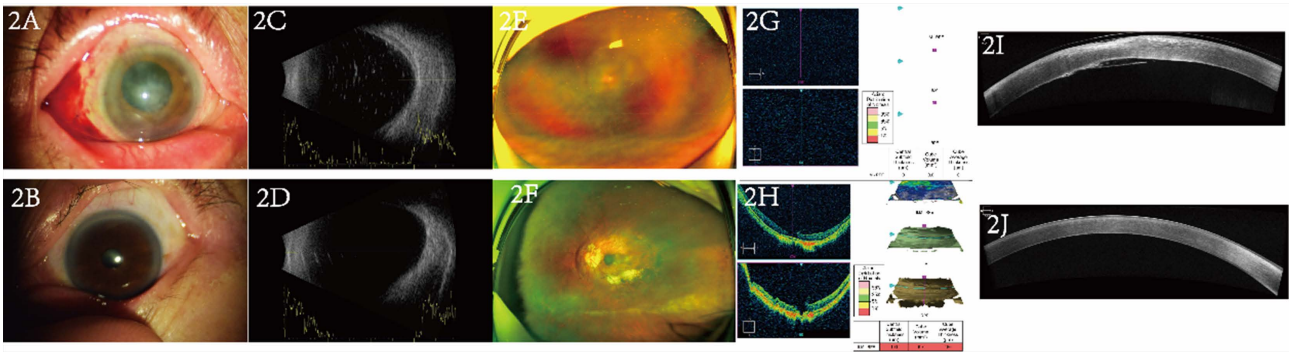

Figure 2. The patient underwent anterior segment photography, ocular ultrasound, fundus photography and macular OCT after silicone oil removal (2(A), 2(C), 2(E), 2(G), 2(I): right eye; 2(B), 2(D), 2(F), 2(H), 2(J): left eye).

From ocular ultrasound, we observed a small amount of silicone oil droplets remained in the vitreous cavity and axial elongation and posterior scleral staphyloma (**Figure 2(C)**). Since the cornea was still cloudy and edema, we were still unable to observe the fundus through fundus photography and macular OCT (**Figures 2(E)-(H)**). The corneal epithelium was intact, the Bowman membrane was scarred, the corneal stroma irregularities and the Descemet's membrane shrank and partially separated from the endothelial cell layer (**Figure 2(I)**, **Figure 2(J)**). It was a pity that we did not perform corneal OCT before silicone oil removal.

3. Discussion

Ophthalmic silicone oil (SO) is a kind of synthetic polydimetilsiloxanes that presents a lower density than water but a similar refractive index compared with the vitreous. The viscosity of SO may vary from 1000 - 5000 Centistokes according to the type of molecule [3]. The intraocular SO could limit the movement, as well as separate the cytokines between the anterior and posterior segment of the eye. Due to such favourable advantages SO is an optimal option in difficult cases including those with giant retinal tears and proliferative vitreoretinopathy [4].

However, a variety of complications particularly relating to longer-term tamponade cannot be ignored. A frequent modification occurs to silicone oil emulsification and duration of the SO tamponade is considered as the most significant factor [5]. The mean emulsification time was 13.2 ± 4.8 months ranging from 5 months to 24 months and most cases presented the typical time course [6]. The investigator also explained it as repetitive shear force provided by ongoing nystagmus might promote the speed of SO emulsification [7]. So far the recommendations for removal of SO ranges from 3 months to 6 months, but there is no agreement on the most optimal timing for which the most important reason is the lack of sufficient knowledge about intraocular SO emulsification including the mechanism and duration of the entire process. Our patient has been filled with silicone oil for 10 years, and her visual function is lost, which is really unfortunate.

The permanent contact of SO was thought to take responsible for SO-induced corneal complications [8], but Szaflik *et al.* [9] performed confocal microscopy of the cornea for those patients with residual SO in the anterior chamber and examined the stromal abnormalities and corneal endothelium lesions from which revealed some corneal alteration had occurred in patients without dislocation of SO into the anterior chamber. Foulks GN *et al.* [10] used light and electron microscopy to confirm endothelial cell damage in patients who developed corneal complications following the use of intraocular SO. The loss of endothelial cells, together with the formation of a posterior collagenous layer and irregular fibrous scarring, correlates with clinical corneal edema and the appearance of endothelial and deep stromal irregularities [10]. We recommend that patients requiring the utilization of intraocular SO tamponade be monitored by a combination of slit-lamp examination, specular microscopy and corneal thickness measurements to determine the relative corneal endothelial tolerance to the silicone oil.

Secondary glaucoma can occur in both the early and late postoperative stages. In the early period, an excessive amount of SO, a pupillary block, SO into the anterior chamber, inflammation and utilization of steroids could contribute to the elevation of IOP. Additionally, patients with any complication including preexisting glaucoma, iris neovascularization, aphakia, and chronic uveitis confront a higher risk of secondary glaucoma [11]. For the late postoperative stages, a pupillary block, rubeosis iridis, synechial angle closure, and dislocation of non-emulsified SO droplets into the anterior chamber may take responsibility for subsequent glaucoma. Progressive SO emulsification and migration into the anterior chamber could induce oxidative stress to change the trabecular meshwork which results in a reduction of aqueous outflow and eventually contributes to chronic elevation of IOP [12]. Interestingly, in this case, the patient did not have eye pain and headache until 6 months before the operation. On the other hand, animal experiments also confirmed that after SO droplets migrated into the anterior chamber for 8 weeks, the reduction of ganglion cells and axons could reach 80% and 60%, respectively due to the increase of IOP instead of the

retinal toxicity of SO itself [13].

Although SO is widely applied as intraocular tamponade, the risk of vision loss either during tamponade or after removal could not be ignored. Functional and morphological alterations with various durations of tamponade could be induced by the intraocular SO, and the positive correlation between the duration of SO tamponade and the final visual acuity in retinal detachment (RD) patients was observed [14]. Multiple studies indicated that intra-retinal cysts and retinal thinning caused by SO tamponade and ganglion cell apoptosis may be the reason for vision loss [15]. Santos *et al.* [16] suggested that SO could impact the membrane integrity and lysosome metabolism of retinal cells, which contributed to further retinal cell damage or photoreceptor autophagy. Klettner A [17] found that microglia absorbed SO droplets which induced metabolic reprogramming and secretion of IL-6 and IL-8. The neurotoxic effects of IL-8 have been described before [18]. Long-term exposure of SO for microglia could induce persistent pro-inflammatory alterations and elevation of pro-inflammatory cytokines which contribute to pro-inflammatory status and network developing neurotoxicity of microglia [19]. We are also inspired by this case. We are conducting animal experiments in rhesus monkeys. We found that after 6 months of silicone oil tamponade, the pyroptosis of ganglion cells increased. This experiment has not been completed yet.

4. Conclusion

In conclusion, SO should be removed in time after PPV. Furthermore, a deeper understanding of SO tamponade pathogenesis may help to improve the visual outcome after surgery in the future.

Availability of Data and Materials

The datasets used and/or analyzed during the present study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate: N/A.

Consent to publish: We have informed the patient and she agreed to publish it.

Availability of data and materials: N/A.

Funding: No funding was obtained for this study.

Authors' Contributions: **MB** was mainly responsible for writing case reports and editing pictures. He is also responsible for submitting and revising case reports; **YL** was responsible for revising the language of the case report and adjusting the logic of the whole case report; **WG** was responsible for helping patients improve various examinations before and after operation, and providing examination results and pictures of patients; **YH** was responsible for observing and recording the changes of the patient's condition every day; **BL** was responsi-

ble for accessing the patient's case data; **HL** was the operator of the operation and reviewed and revised the manuscript before submission.

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N/A.

Statement

The submission of this case report obtained the written consent of all participants.

Conflicts of Interest

The author declares that there is no conflict of interests regarding the publication of this paper.

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Abbreviations

SO	Silicone oil
PPV	Pars plana vitrectomy
OCT	Optical coherence tomography
PSC	Posterior subcapsular cataract
NS	Nuclear sclerotic
RD	Retinal detachment