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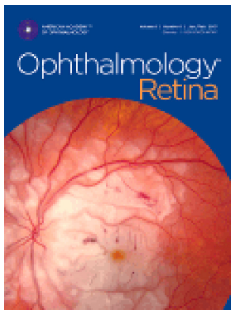

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Improved outcomes in patients with retinal detachment following implementation of a silicone oil registry and phone call reminder system

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Abstract

Purpose: This retrospective study was performed to assess the clinical impact in reducing silicone-oil related complications such as keratopathy of a registry and appointment reminder system for patients with complicated retinal detachment (RD) who underwent pars plana vitrectomy (PPV) with silicone oil (SO) tamponade.

Design: Retrospective cohort study

Participants: A total of 87 eyes of 87 patients who received SO tamponade were included.

Methods: The study was carried out at Zuckerberg San Francisco General Hospital and Trauma Center (ZSFG). Patients were divided into those who received SO either before (control group, n=48) or after (treatment group, n=39) implementation of a SO registry and patient reminder system in 2014. Patient records were reviewed to identify clinical characteristics and outcomes.

Main Outcome Measures: The primary outcome measure was the difference in the rate of loss to follow-up, before versus after the implementation of the registry and reminder system. Secondary outcomes were the duration of SO tamponade, keratopathy rate, and intraocular pressure (IOP) at the last visit before SO removal.

Results: Forty-eight patients were included in the control group, and thirty-nine in the treatment group. The number of patients lost to follow up was 23

(47.9%) in the control group versus six (15.4%) in the treatment group (p=0.0015). The mean duration before SO removal was 79.6 ± 91.7 weeks in control group, and that of treatment group was 36.3±31.5 weeks (Mean ± SD) (p=0.015). Keratopathy developed in 33.3% of patients in the control group and in 12.8% in the treatment group (p=0.0425). Mean IOP at last visit before SO removal was 13.0 ± 5.2 mmHg (Mean ± SD) in control group and 13.3 ± 7 mmHg (Mean ± SD) in treatment group (p>0.05).

Conclusions: A phone call appointment reminder system for patients with complicated RD who underwent PPV and SO tamponade reduced the rate of loss to follow-up and the duration of silicone oil tamponade, correlating with a reduction in the rate of keratopathy.

Introduction

Complex retinal detachment (RD) associated with proliferative vitreoretinopathy (PVR), giant retinal tear (GRT), proliferative diabetic retinopathy (PDR), ocular trauma and other causes can lead to significant vision loss and even legal blindness. Since it was first described in 1962,[1] silicone oil (SO) has been demonstrated to be an effective intraocular tamponade and has become part of the standard technique for complex retinal detachment repair,[2,3] a frequent choice for vitreous replacement following pars plana vitrectomy (PPV) in these complex cases.[4–7] However, it is still not a perfect or ideal permanent vitreous replacement because of its possible complications such as keratopathy, glaucoma, and cataract due to long term exposure.[8] In clinical practice, although it may be necessary to leave SO in the vitreous cavity as long as possible in a small group of patients with unusually complex findings, for most patients, silicone oil is usually removed after 3-6 months in order to avoid complications.[9] Therefore, once SO is implanted in the eye, the clinical status of the eye must be monitored carefully to detect any complications and determine the appropriate amount of time that the SO should remain in order to achieve the goal of lasting retinal reattachment. In other words, regular follow-up appointments are needed in order to allow the clinician to observe the patient and adjust the timing of intervention as needed.

Most SO-related complications relate to emulsification. Keratopathy, glaucoma and cataract are the main complications of concern. The main risk factor for emulsification is duration of SO tamponade, with occurrence from 5 to 24 months after SO injection; in most cases, emulsification is detectable within the first year.[10] Because of the variability in time to emulsification, regular follow-up is the key to balancing the anatomical and functional status of the eye and complications due to SO emulsification. Missed appointments at the surgeon's office can lead to delay in treatment and unexpected complications. Although many factors interfere with patient follow-up,[11] the most common reason for missed appointments is that the patient simply forgets.[12] Thus, there are various strategies including email, phone calls, letters and text messages that have been used as reminders in order to reduce missed appointments. Several studies have found that a personal phone call reminder can improve adherence to follow-up.[13–15]

Recently, some studies have documented an improvement in patient care outcomes in ophthalmology with phone call reminders in areas such as glaucoma[16,17] diabetic retinopathy[18] and age-related macular degeneration.[19] To the best of our knowledge, no study has evaluated the efficacy of a registry and phone call intervention to improve the rates of adherence and treatment outcomes in patients with complicated RD receiving SO tamponade. The objective of this study was to evaluate the clinical significance of a follow-up

appointment reminder system for patients with complicated RD who underwent PPV with SO tamponade.

Methods

After approval by the Human Research Protection Program at the University of California, San Francisco and Zuckerberg San Francisco General Hospital and Trauma Center (ZSFG), we conducted a retrospective review of a prospectively collected cohort of complex RD patients who underwent PPV with SO injection at ZSFG between 2006 and 2017. Part-way through that time period, in 2014, the Department of Ophthalmology at ZSFG implemented a phone call follow-up appointment reminder system for patients receiving SO injection. Clinic staff created a prospective registry of all patients receiving silicone oil injection. Once the 6-month duration of silicone oil implantation was reached, staff tracked whether the patient attended their 6-month appointment and whether the SO removal surgery was scheduled and completed. This was in addition to standard call-backs for individual missed clinic appointments, as is utilized widely in our practice and in others. In the event that the patient did not attend follow-up visits, staff persisted to contact the patient by phone multiple times to reschedule the appointment and confirm attendance. Staff also actively communicated with surgeons to ensure that SO removal was arranged and completed.

For the retrospective review conducted in this study, patients with complex RD who underwent PPV with SO injection between 2006 and 2017 and maintained an attached retina for more than three months were included. Patients were divided into two groups according to the date on which the surgery was performed. The control group consisted of patients who underwent the procedure before 2014, prior to the implementation of the registry and phone call reminder system; the treatment group consisted of patients whose surgery was in 2014 or later, with the new system in use.

Parameters analyzed for the study included age, gender, indication for surgery, duration before SO removal, time to follow-up, occurrence of keratopathy, the no-show rate in the treatment group, and intraocular pressure (IOP) at the last visit before SO removal. The loss to follow-up rate was calculated and relates to patients who underwent PPV with SO injection who disappeared from follow-up for more than 6 months and did not return for SO removal at all throughout the entire study period (to the end of 2017). Keratopathy was defined as corneal complications including band keratopathy, corneal decompensation, and corneal opacities. A no-show was defined as a patient who missed a scheduled appointment without having cancelled it ahead of time. Since there was no intentional tracking of the scheduled appointments in the control group, the no-show rate was only calculated for the treatment group.

Categorical variables were compared between the two groups using SPSS software (version 21, IBM, Armonk, NY, USA) for statistical analysis. An independent t-test was used to compare age and the duration before SO removal between the two groups. The Wilcoxon Mann-Whitney test was used to compare the gender of the two groups. Results were considered significant at $p < 0.05$.

Results

Patients with complex RD who underwent PPV and 5,000-centistoke SO injection by the same attending physician, assisted by rotating residents and fellows, in the ophthalmology department at Zuckerberg San Francisco General Hospital between January 27, 2006 and June 30, 2017 were included in the study. Out of these patients, 48 were included the control group (no phone call reminder), and 39 patients in the treatment group (with phone call reminder).

Baseline demographics were comparable between the two groups (Table 1). There was no significant difference in age and gender between the two groups. The median age in the control group was 54.4 [45.0-59.9] years, and that of the treatment group was 55.0 [42.5-60.2] years. The control group consisted of 36 men and 12 women, while there were 27 men and 12 women in the treatment group. The number of patients with complex RD associated

with PVR, PDR, ocular trauma, GRT, and other causes was 14, 12, 7, 5, 9 respectively in the control group, and was 20, 9, 7, 3, and 0 respectively in the treatment group.

With regard to the primary outcome measure, the number of patients lost to follow up was 23 (47.9%) in the control group versus 6 (15.4%) in the treatment group (p=0.0015) (Figure 1). The remainder in each group (25 controls and 33 treatment eyes) underwent SO removal. The mean duration of SO in the eye before removal was 79.6 ± 91.7 weeks in the control group, and in the treatment group it was 36.3±31.5 weeks (mean ± SD) (p=0.015) (Figure 2A). Mean IOP at the last visit before SO removal in the control group was 13.0 ± 5.2 mm Hg (mean ± SD) and in the treatment group was 13.3 ± 7 mm Hg (mean ± SD) (p>0.05) (Figure 2B). There were 16 (33.3%) patients in the control group who developed keratopathy, while only 5 (12.8%) in the treatment group did (p=0.0425) (Figure 3). Within the control group there was a trend toward longer duration of SO tamponade correlating with the development of keratopathy as an independent variable: the mean duration of SO tamponade was 118.2 weeks in eyes developing keratopathy versus 60.1 weeks in eyes without keratopathy (p=0.09); in the treatment group, the mean duration of SO was 28.2 weeks in eyes with keratopathy and 32.2 weeks in eyes without keratopathy (p=0.96). In the treatment group, the number of appointments kept was 232, while the number of no-show visits was 30, yielding a no-show rate of 11.5% (30/262). Finally, 100% of patients in the

198 treatment group were able to be examined or reached by phone at least once
199 during the post-operative period.

200

201 **Discussion**

202 To the best of our knowledge, this is the first study to evaluate the efficacy of a
203 registry system with phone call intervention to improve the rates of adherence
204 and treatment outcomes in patients with complicated RD undergoing PPV with
205 SO tamponade. In our study, patients with complex RD after surgeries in the
206 phone call reminder group were significantly more likely to adhere to the
207 recommended schedule and keep their eye examination appointments when
208 compared to patients without any tracking and intervention. This study found
209 that the number of patients lost to follow-up markedly dropped after
210 implementation of the registry and reminder system, from 23 (47.9%) to 6
211 (15.4%). Loss to follow up may represent a broader problem in the
212 management of vitreoretinal disease, as a recent study showed that the rate
213 exceeded 20% after anti-vascular endothelial growth factor injections.[20] The
214 results of the present study indicate that a phone call reminder call system can
215 be an effective means of improving patient compliance with follow-up
216 examinations and surgical treatment. These findings are supported by
217 previous studies demonstrating that a personal phone call appointment
218 reminder can improved adherence to follow-up appointments,[13–15] despite the

fact that there are various reasons for patients not adhering to a schedule of follow-up appointments. [11,21–23]

In this series, reducing the loss to follow-up rate improved patient safety and outcomes, largely by shortening the time that SO remained in the patients' eyes. Indeed, duration of SO tamponade has been shown to be the greatest risk factor for SO emulsification, which can lead to keratopathy, glaucoma, and cataract.[10] Keratopathy as one of the complications of SO tamponade declined significantly after implementation of the registry and reminder system, in conjunction with the reduced duration of SO in the eye in the treatment group.[10] IOP was not significantly different between the groups, possibly because it was able to be controlled with eyedrops in both groups. Cataract formation was not analyzed as an outcome measure in this study for two reasons. First, unlike keratopathy or glaucoma, cataract formation does not lead to a permanently poor outcome, since it can be addressed surgically at any point; second, many patients had cataract removal in combination with their retinal detachment repair or silicone oil removal procedures.

In this study we also determined the no-show rate in the treatment group. This may be an important index in that it represents not only the care of the patients in question but also the experience of the clinic population in general due to the negative impacts that no-shows have on clinic efficiency. The no-show rate of 11.5% achieved in the treatment group is similar to the goal of

10% that is often established as a target for efficiency and to avoid disruption of clinic operations. [24] This reinforces the added value to clinic efficiency brought about by the SO registry and reminder system and is consistent with prior reports showing that reminders can improve ophthalmic follow-up adherence. [25,26]

There are several limitations to this study. One is that the study describes a retrospective cohort without randomization. This was necessarily the case since it tracks the change in practice in our department in the management of patients with SO. As such, the number of patients is not matched between the groups. In addition, the study is limited by its small sample size and the fact that the assessment takes place at only one center. Also, ZSFG is a public, safety net hospital whose patient composition may overrepresent persons with socioeconomic challenges relative to the broader population, potentially limiting the generalizability of our results. On the other hand, the dramatic impact of the SO registry in improving outcomes in this particular patient population may suggest that benefits could be achieved even in settings with traditionally less difficulty in ensuring patient adherence to follow-up. Indeed, studies suggest that significant problems with follow-up exist in other, non-safety net populations with ophthalmic disease. [20]

Another limitation is in the scope of patient parameters analyzed, as they relate to follow-up compliance. It is possible that a more specific analysis of patient characteristics, such as socioeconomic status, extent of family support,

housing status, race or ethnicity, and retinal detachment complexity could identify additional factors affecting follow-up that could enable a more focused application of staff resources to ensure compliance in a subset of SO patients. In the absence of such a targeted approach, our data supports implementation of a registry such as that in use at ZSFG.

Conclusions

In this study, we found that a patient registry and phone call follow-up appointment reminder system for patients receiving SO tamponade significantly improved attendance at follow-up appointments and reduced the duration of SO in patients' eyes. Patient outcomes were improved, most concretely by a reduction in the rate of keratopathy with the use of the registry. Further studies are indicated to evaluate the generalizability of these results to other patient populations.

Figure Legends:

Figure 1:

The loss to follow-up rates in the Control and Treatment groups. The number of patients lost to follow-up was 23 (47.9%) in the control group versus 6 (15.4%) in the treatment group (p=0.0015).

Figure 2:

(A) Mean duration before SO removal between the Treatment and Control groups, showing a significant difference (p=0.015). (B) Mean IOP in the two groups, showing no significant difference (p>0.05). Error Bar: Standard Error. SO: silicone oil; IOP: intraocular pressure.

Figure 3:

Keratopathy developed in 16 (33.3%) patients in the Control group, while only 5 (12.8%) in the Treatment group did (p=0.0425).

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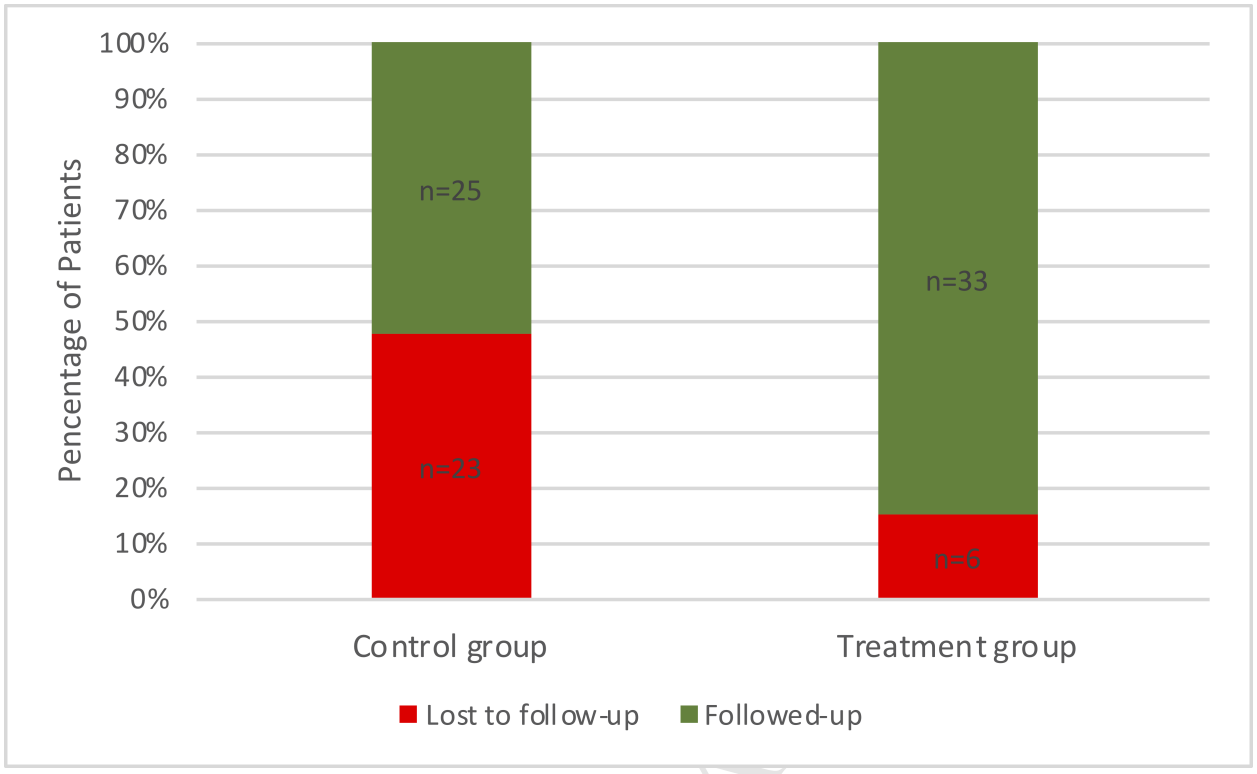
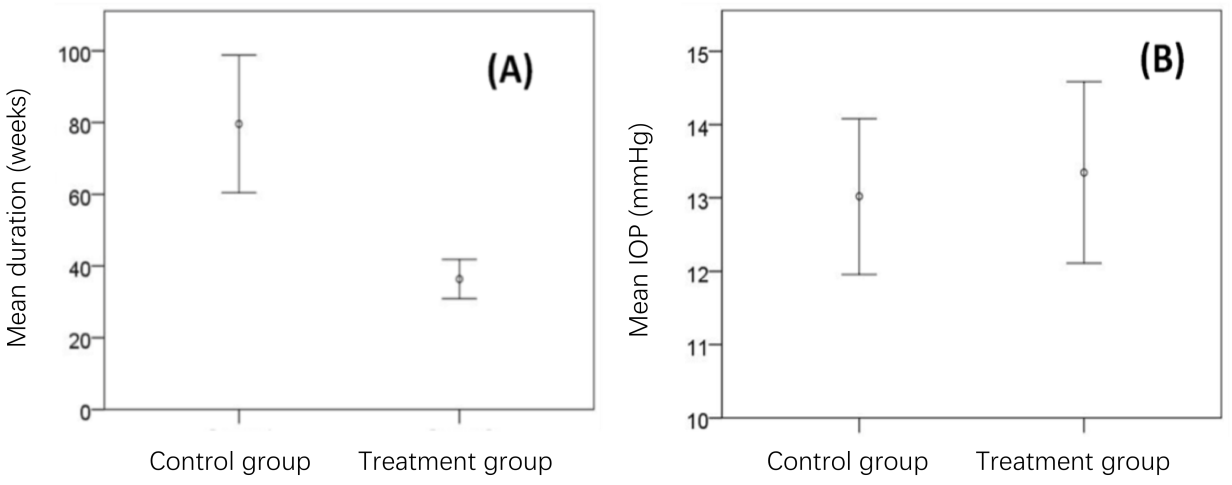
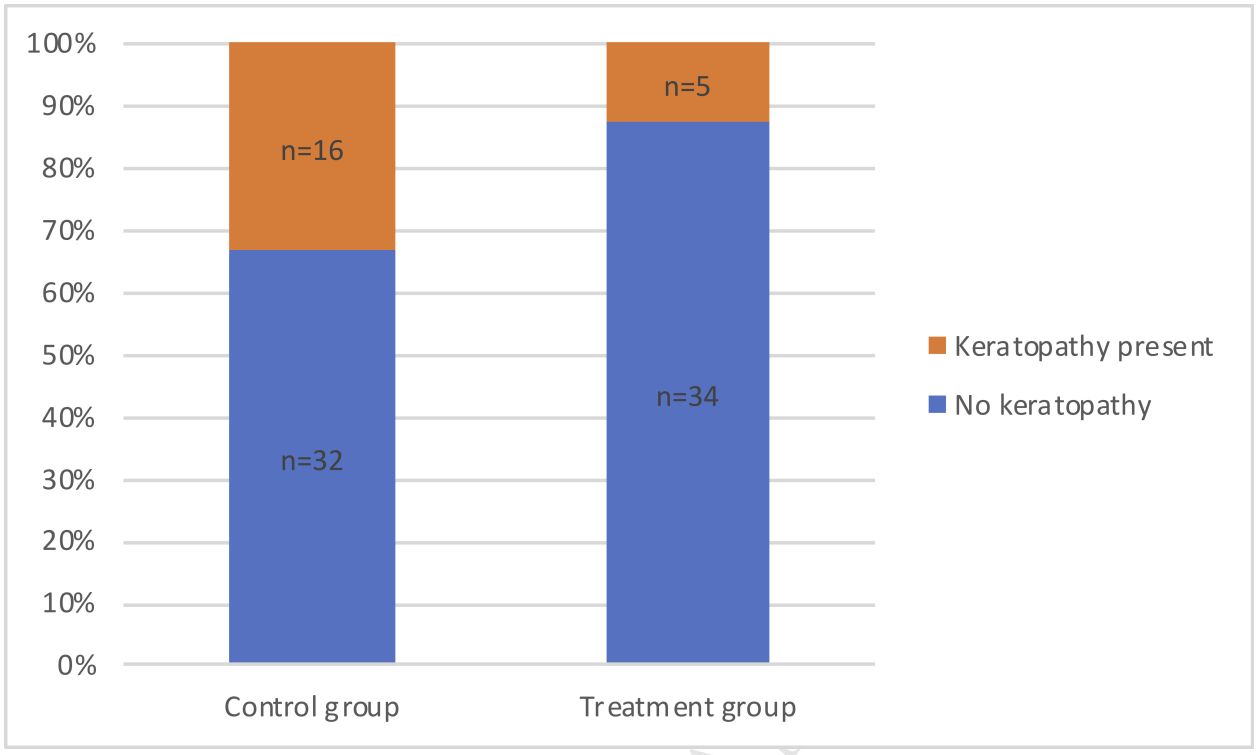
Table 1: Baseline patient characteristics

	Control group		Treatment group		p-value
Gender					0.55
Male (n)	36		27		
Female (n)	12		12		
	Median	[IQR]	Median	[IQR]	
Age (years)	54.4	[45.0-59.9]	55.0	[42.5-60.2]	0.73
Diagnosis					
PVR (n)	14		20		
PDR (n)	12		9		
GRT (n)	5		3		
Ocular trauma (n)	7		7		
Other (n)	9		0		

PVR, proliferative vitreoretinopathy; PDR, proliferative diabetic retinopathy; GRT, giant retinal tear; IQR, interquartile range







Precis

Implementation of a silicone oil registry and phone call reminder system improved rates of adherence to follow-up appointments and treatment outcomes in patients with complicated retinal detachment who underwent vitrectomy with silicone oil tamponade.