

The Potential benefit of 360-degree laser retinopexy before silicone oil removal for the prevention of retinal re-detachment

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ABSTRACT

Background: This study aims to investigate the potential impact of performing a 360° laser barrage before silicone oil removal (SOR) on the incidence of retinal re-detachment in patients who have previously experienced retinal detachment.

Methods: In this cross-sectional study, 52 patients with primary Rhegmatogenous retinal detachment (RRD) referred to the Ophthalmology clinic from March 2017 to May 2020 were examined one day, one week, one month, and three months after SOR. Routinely, RRD patients undergo G23 pars plana vitrectomy (PPV) and silicone oil injection. If they have attached retina, 360° degrees argon laser in 3-4 rows was performed in 2 sessions with one-week intervals, and finally, silicone oil will be removed at least one month after barrage laser. Finally the surgery outcomes were compared between PPV and SOR in different durations..

Results: 52 patients (52 eyes), including 13 females and 39 males, with a mean age of 61.44 ± 11.14 were evaluated. There was no retinal re-detachment after silicone oil removal in patients with three-month observation. The mean duration between the two operations (PPV and SOR) was 330 ± 174 days (range: 136 days to 918 days), and there was a negative correlation -0.43 (P -value = 0.001) between it and final visual acuity.

Conclusion: This study demonstrates that 360-degree laser therapy has the potential to decrease the occurrence of retinal detachment following silicone oil removal. Furthermore, as more silicone oil remains in the eye, the final vision is further decreased.

Keywords: Rhegmatogenous retinal detachment, vitrectomy, visual acuity, pars plana vitrectomy, laser

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INTRODUCTION

Rhegmatogenous retinal detachment (RRD) is the most common type of retinal detachment (RD), and this emergency condition can lead to blindness(1). It occurs when the neurosensory retina separates from the underlying retinal layer. Most cases complain about the perception of light flashes, floaters, or dark curtains(2). RRD commonly occurs in the sixth to seventh decades of life. The leading risk factors include Myopia, cataract surgery, trauma, and others (3-6).

RRD has been treated with various methods, including pars plana vitrectomy (PPV), scleral buckle, pneumatic retinopexy, and laser or cryopexy in selected cases (7). Retinal re-detachment can occur

after all of these surgical procedures (8, 9). Currently, PPV with silicone oil injection is a standard method in primary rhegmatogenous retinal detachment repair (10, 11). Since silicone oil can lead to long-term complications, such as corneal endothelium failure, secondary glaucoma, or cataracts, it should be removed as soon as the retinal condition stabilizes (12, 13).

Re-detachment is one of the significant complications of silicone oil removal (SOR), usually occurring during the first three months after SOR. It occurs in 25% to 30% of patients undergoing SOR (10,11). After SOR, various mechanisms have been proposed for retinal detachment (RD), including reopening the previous break, new break formation, stretching on the vitreous base, posterior extension in the remaining and hidden RD cases, and anterior PVR



(Proliferative Vitreoretinopathy) occurrence (13-15).

Due to the poor visual prognosis following retinal re-detachment after SOR, It is necessary to find ways so as to reduce the risk of this situation (8, 16, 17). One proposed method to prevent retinal re-detachment is 360-degree retinal laser therapy, which can be performed during deep vitrectomy or as an outpatient method before silicone oil removal surgery (18, 19).

Performing 360-degree laser therapy during PPV vitrectomy surgery can lead to complications, such as prolonged surgery time, lens trauma, and cataract formation, as well as the possibility of retinal trauma and retinal perforation or bleeding (19). Therefore, in this study, we evaluate the potential effectiveness of 360-degree retinal laser therapy before SOR surgery to prevent Retinal Re-detachment.

MATERIALS AND METHODS

In this prospective cross-sectional study, patients with RRD referred to the Ophthalmology Clinic from March 2017 to May 2020

were included. All patients with post-vitrectomy RRD, RRD following ocular trauma, and RRD associated with the intraocular foreign body were excluded.

In the clinic, a careful intraoperative search is performed to find all retinal breaks, and barrier lasers are used around all tears during primary PPV surgery. The 5700 cs SO (Oxane, Bausch & Lomb Inc., Ireland) was used for all patients. Two months after PPV, the 360° barrier laser is performed for all patients as an outpatient. Barrier laser undertakes using a Superquad lens in 3-4 rows of laser spots with half spot size intervals in the most peripheral part of the retina that is visible with a Superquad lens. The 360° laser retinopexy would be completed in 2 sessions with a one-week gap. Finally, silicone oil is removed at least one month after 360° barrier laser completion (Figure 1)*. All surgeries had been done by one person (HT).

Patients were examined one day, one week, one month, and three months after SOR. Visual acuity was measured with a Snellen chart, and fundus examination was done by indirect ophthalmoscopy after pupil dilation three months after SOR surgery.

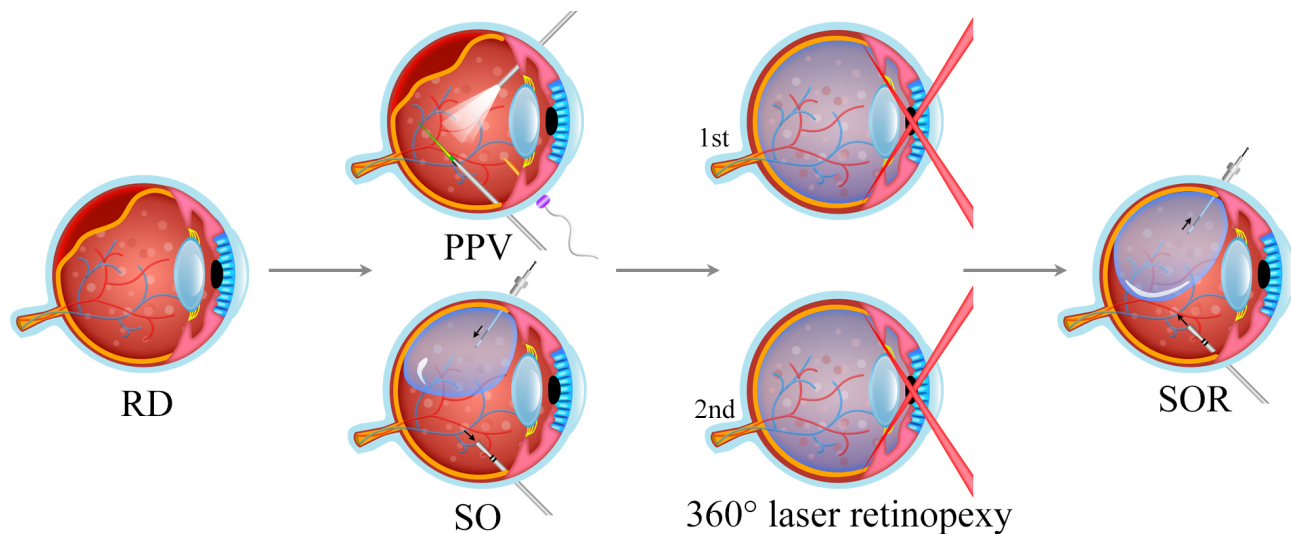


Figure 1. The treatment process that has been done for patients with RRD in the ophthalmology clinic

STATISTICAL ANALYSIS

Statistical analysis was done using SPSS statistical software version 16. Numerical data were shown as mean $\pm$ standard deviation, and Qualitative data were demonstrated in frequency and percentage. Quantitative variables after the normality test were analyzed by the Pearson test. In all tests, P values less than 0.05 were considered significant.

RESULTS

This study evaluated 52 patients (52 eyes), including 13 females and 39 males, with a mean age of 61.44 ± 11.14 (range: 37 to 83 years old). The right eye was affected in 28 (53.84%) patients. All of the patients had total RD. Furthermore, the sites of the RD were above 8 o'clock in all eyes. The mean time for the diagnosis to surgery was 7 days.

In seven patients, PPV was performed by phacoemulsification, and in 20 patients, SOR was accompanied by phacoemulsification. Twenty-five patients had a history of phacoemulsification.

The mean sphere and cylinder after PPV surgery were 0.57 ± 2.10 and -1.15 ± 0.39 , respectively.

The mean duration between the two operations (PPV and SOR) was 330 ± 174 days (range: 136 days to 918 days). None of the patients have had re-detachment after SOR surgery.

Three months after SOR, the mean best corrected visual acuity (BCVA) was 0.43 ± 0.7 (range: 1 to 0). A negative correlation between patients' BCVA after SOR and the interval between two surgeries was shown to be -0.43 (P-value = 0.001).

DISCUSSION

RRD is an emergency that could lead to irreparable consequenc-

es, so efficient prevention and treatment are necessary. Despite advances in surgical techniques, the visual prognosis is not good in many cases. Nowadays, PPV is the standard treatment for RRD repair; however, it is not yet associated with excellent results. The anatomical success rate of G23 PPV is 80 to 96.2%, and Re-detachment after SOR is the major complication that occurs in 20 to 25% after SOR (20). Therefore, it is of great importance to use different methods for reducing the retinal re-detachment after SOR, such as a scleral buckle or 360-degree retinal laser. Currently, few studies have been done on retinal 360-degree barrier lasers to prevent retinal re-detachment after SOR (21-23).

Performing intra-operative 360-degree barrier lasers increases the operation time and the complications of the operation; In this regard, we tried to enroll patients who have undergone a 360-degree retinal laser as a separate procedure from primary vitrectomy surgery.

Our findings indicate that performing 3-4 rows of 360-degree retinal laser therapy in the anterior equator, about one month prior to SOR, is associated with a reduction in the incidence of retinal re-detachment after SOR (during at least three months of follow-up). In addition, Ultimate visual acuity was inversely correlated to silicone oil retention time in the eye. As a consequence, the removal of SO at once may improve visual acuity outcomes.

Barrada et al. (2015) in a prospective study have shown that, Forty eyes received vitrectomy in addition to the retinal breaks lasers and a 360-degree barrier laser anterior to the equator. The other 40 eyes performed lasers only around the breaks. Finally, retinal re-detachment occurred in 9 eyes (22.5%) of the first group and 13 eyes (32%) of the second group ($P = 0.32$). All cases of retinal re-detachment occurred during the first two months after SOR. In our study, the final visual acuity of patients was between 0.001 and 1 decimal point (21).

Some studies implied that 360-degree laser treatment can be useful in preventing RRD. Avitabile et al. (2008) found that the rate of retinal re-detachment was decreased from 21.4% to 8.6% in RRD patients received 360-degree laser treatment during vitrectomy or before SOR as an outpatient method in comparison to the control group (22). The study of Laidlaw et al. also evaluated 287 eyes that underwent vitrectomy due to RRD. This study demonstrated that 360-degree prophylactic laser therapy (during primary vitrectomy or before SOR) reduce the risk of retinal detachment from 26% to 14% in comparison to the control group, which didn't receive that (24). These findings are aligned with our study results.

Moreover, Tufail et al. also reported that performing a 360-degree laser on 31 eyes of 31 patients, 3 to 6 weeks before silicone removal, could be effective in retinal re-detachment (25).

In a retrospective study conducted in 2011, Falkner et al. followed 111 patients after SOR, 360-degree laser, and an air tamponade for six months. RRD occurred in ten eyes, and 91% of cases had anatomical success within 6 months of follow-up. 13.5% of patients had a final visual acuity of less than 0.4 logMAR, 55.9% between 0.4 and 1 logMAR, and 30.6% more than one logMAR. The visual acuity results in this study were almost similar to our research. However, in Falkner et al. research, the duration of silicone oil re-

tention in the eye was not significantly correlated with final visual acuity, which is not consistent with the result of our study(23).

Two different methods have been used for 360-degree retinal laser, the first laser during primary vitrectomy and the second 360-degree laser as a separate procedure before silicone oil removal surgery. Although most studies have confirmed the effectiveness of the 360-degree laser in reducing the risk of retinal detachment, few studies have compared the results of these two methods. Our study also showed the probable effectiveness of a 360-degree laser before silicone removal in preventing retinal re-detachment. Inevitably, the study has several limitations that need to be acknowledged. First of all, the sample size was relatively small, which may limit the generalizability of the findings. A larger sample would provide more robust results. Additionally, the study was conducted at a single center, which might introduce bias or limit the external validity. Conducting multi-center studies could enhance the study's reliability. Furthermore, the follow-up duration was limited to three months. Longer follow-up periods would allow for the assessment of the long-term effects of the intervention. Moreover, the optimal timing for silicone oil removal remains uncertain, and variability in the timing of removal could impact outcomes. Finally, as a cross-sectional study, It is essential to conduct a randomized clinical trial(RCT) with systematic follow-up to reduce bias and achieve perfect reliability in results. The RCT could include a larger sample, multiple centers, and longer follow-up to strengthen the evidence.

Laser therapy during primary vitrectomy for RRD can increase the risk of surgical complications, such as damage to the lens and posterior lens capsule, retinal rupture, and retinal bleeding or choroidal hemorrhage. Furthermore, increasing the time of surgery and the surgeon's fatigue can increase the operation complications. Accordingly, in this study, we tried to reduce these possible complications by using a 360-degree retinal laser as a separate procedure from primary vitrectomy surgery.

CONCLUSION

According to the findings of this study, a 360-degree laser before silicone oil removal probably reduces the incidence of retinal re-detachment after SOR. In addition, it can be considered that by increasing the residence time of silicone oil, the final vision results could be further reduced. Other studies with more participants, especially clinical trials, are recommended to confirm these findings.

CONFLICT OF INTERESTS

There are no conflicts of interest in terms of the present manuscript.

ETHICAL CONSIDERATION

All study was done according to the ethical principles of the Declaration of Helsinki. Informed consent was obtained from every enrolled subject.

The Ethics Committee approved this study (BAQ.REC.1399.029).



ABBREVIATIONS

SOR; silicone oil removal, RRD; Rhegmatogenous retinal detachment, PPV; pars plana vitrectomy, RD; retinal detachment, PVR; Proliferative Vitreo Retinopathy.

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