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INCIDENCE OF RETINAL REDETACHMENT AFTER ROSO IN PATIENTS OF RRD TREATED VIA PPV WITH AND WITHOUT 360-DEGREE LASER RETINOPEXY

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ABSTRACT

Objective: *To evaluate the incidence of retinal redetachment after removal of silicone oil (ROSO) in patients with rhegmatogenous retinal detachment (RRD) treated via pars plana vitrectomy (PPV), comparing outcomes between those treated with 360-degree laser retinopexy and focal laser retinopexy.* ***Methods:*** *This retrospective study included 65 patients with primary RRD treated with PPV and silicone oil tamponade. Patients were divided into two groups: Group A (33 patients), who received 360-degree laser retinopexy, and Group B (32 patients), who underwent focal laser retinopexy. The incidence of retinal redetachment after ROSO, visual acuity outcomes, and associated risk factors were analyzed. Statistical tests included chi-square and logistic regression analyses.* ***Results:*** *The incidence of retinal redetachment was significantly lower in Group A (6.1%) compared to Group B (28.1%) ($p = 0.03$). Visual acuity improved in both groups, with Group A achieving better postoperative BCVA (0.8 ± 0.2 logMAR) than Group B (1.1 ± 0.3 logMAR) ($p = 0.04$). Risk factors for redetachment included the absence of 360-degree laser retinopexy, PVR Grade C or higher, and prolonged silicone oil tamponade (>4 months).*
Conclusion: *360-degree laser retinopexy significantly reduces the risk of retinal redetachment after ROSO and improves visual outcomes compared to focal laser retinopexy. This technique is effective and safe, particularly in high-risk cases, and should be considered in surgical planning for RRD management.*

Keywords: *Rhegmatogenous retinal detachment, 360-degree laser retinopexy, pars plana vitrectomy, silicone oil removal, retinal redetachment, proliferative vitreoretinopathy, visual outcomes, postoperative complications, risk factors.*

INTRODUCTION

Rhegmatogenous retinal detachment (RRD) is a significant cause of vision loss worldwide, necessitating prompt and effective surgical intervention to restore the anatomical structure of the retina and prevent further deterioration of visual function. Among the various surgical techniques available, pars plana vitrectomy (PPV) has emerged as a cornerstone for the treatment of RRD, especially in cases involving complex retinal pathologies, proliferative vitreoretinopathy (PVR), or large retinal tears [1]. PPV allows for the removal of vitreous traction, repair of retinal breaks, and the use of tamponade agents such as silicone oil or gas to stabilize the retina postoperatively. While initial reattachment rates are high with PPV, the risk of postoperative

complications, particularly retinal redetachment after the removal of silicone oil (ROSO), remains a critical concern [2].

Silicone oil is commonly employed as a long-term tamponade in the management of complex or high-risk RRD cases. Its ability to provide mechanical support to the retina while maintaining optical clarity makes it a valuable tool in vitreoretinal surgery. However, its use is not without drawbacks, as long-term retention can lead to complications such as emulsification, increased intraocular pressure, and keratopathy [3]. Consequently, the removal of silicone oil is often performed after adequate retinal stabilization. Unfortunately, ROSO has been associated with a risk of retinal redetachment, with reported incidences varying widely across studies [4]. Factors contributing to redetachment include incomplete retinal healing, residual vitreoretinal traction, unrecognized or untreated peripheral retinal breaks, and the presence of PVR [5].

To mitigate the risk of postoperative redetachment, various surgical strategies have been employed, including intraoperative adjuncts such as laser retinopexy. Laser retinopexy involves the application of laser energy to create adhesion around retinal breaks or areas of retinal thinning, thereby forming a chorioretinal scar that reduces the likelihood of further detachment [6]. While focal laser treatment targeting specific retinal breaks is routinely performed during PPV, the use of 360-degree laser retinopexy as a prophylactic measure has garnered attention. This technique involves the creation of a continuous circumferential barrier of laser scars along the peripheral retina, aiming to address potential future sites of detachment that may not be evident intraoperatively [7].

Proponents of 360-degree laser retinopexy argue that it provides additional protection in cases with a higher risk of recurrence, particularly in eyes with extensive retinal pathology or compromised retinal integrity [8]. The theoretical advantage of this approach lies in its ability to preemptively secure areas of the peripheral retina that may develop breaks or tears over time. However, concerns regarding potential drawbacks, such as excessive retinal scarring, impaired peripheral visual field, or choroidal ischemia, have also been raised [9]. Moreover, the clinical evidence regarding the efficacy of 360-degree laser retinopexy in reducing redetachment rates compared to standard focal laser treatment remains inconclusive [10].

Objective

This study aims to explore the incidence of retinal redetachment following ROSO in patients treated with PPV for RRD, comparing outcomes in those who received 360-degree laser retinopexy versus those who underwent focal laser retinopexy. By analyzing data from these two groups, this study seeks to provide valuable insights into the role of 360-degree laser retinopexy as a preventive strategy against postoperative redetachment.

Methodology

This retrospective study was conducted at during. It included 65 patients who underwent pars plana vitrectomy (PPV) for rhegmatogenous retinal detachment (RRD) at a tertiary care center. The inclusion criteria were patients with primary RRD treated with silicone oil tamponade and subsequent removal of silicone oil (ROSO). Patients with a history of prior retinal surgery, traumatic retinal detachment, or significant ocular comorbidities such as diabetic retinopathy or advanced glaucoma were excluded from the analysis. The study aimed to compare the incidence of retinal redetachment after ROSO in patients treated with PPV, with and without 360-degree laser retinopexy.

Data Collection

Clinical data were collected from medical records, including demographics (age, sex), baseline visual acuity, the extent of retinal detachment, presence of proliferative vitreoretinopathy (PVR), and duration of silicone oil tamponade. Intraoperative details, including the use of 360-degree laser retinopexy or focal laser retinopexy, were documented. The 65 patients were divided into two groups based on the surgical approach:

Group A (360-degree laser retinopexy):

Comprised of 33 patients who received 360-degree laser retinopexy during their PPV procedure.

The laser retinopexy was applied circumferentially along the peripheral retina to create a continuous chorioretinal adhesion as a prophylactic measure against future detachment.

Group B (focal laser retinopexy):
Comprised of 32 patients who underwent standard focal laser retinopexy targeting identified retinal breaks during PPV.
No additional prophylactic laser treatment was applied to the peripheral retina.

Surgical Procedure
All surgeries were performed by experienced vitreoretinal surgeons using a standard three-port PPV technique under local or general anesthesia. Silicone oil was used as a tamponade agent in all cases. During surgery, the retina was reattached by relieving vitreoretinal traction, and any identified retinal breaks were treated with endolaser photocoagulation. In Group A, 360-degree laser retinopexy was performed after achieving retinal reattachment. In Group B, only the identified retinal breaks were treated with endolaser photocoagulation. Postoperatively, patients were followed up closely, and silicone oil was removed after sufficient retinal stabilization, typically within 3 to 6 months. Post-ROSO outcomes, including the incidence of retinal redetachment, were recorded over a follow-up period of 12 months. Retinal redetachment was defined as a recurrence of detachment requiring surgical intervention. Secondary outcomes included changes in visual acuity and the identification of risk factors associated with redetachment.

Statistical Analysis
Data were analyzed using SPSS v26. The primary outcome, the incidence of retinal redetachment, was compared between the two groups using chi-square tests. Secondary outcomes, such as changes in visual acuity and the duration of silicone oil tamponade, were analyzed using paired t-tests and multivariate regression models. Potential risk factors for redetachment, including the presence of PVR and the extent of initial detachment, were assessed using logistic regression analysis.

Results
The study included a total of 65 patients (65 eyes) with a mean age of 55.3 ± 8.7 years (range: 35–72 years). Of these, 38 patients (58.5%) were male, and 27 patients (41.5%) were female. Group A (360-degree laser retinopexy) and Group B (focal laser retinopexy) had similar mean ages (54.8 ± 8.5 vs. 55.9 ± 9.1 years, p = 0.64) and gender distributions. The prevalence of proliferative vitreoretinopathy (PVR) Grade C or higher was slightly higher in Group A (36.4%) compared to Group B (31.3%), though this difference was not significant (p = 0.68).

Table 1: Patient Demographics and Baseline Characteristics

Characteristic	Group A (360-degree laser)	Group B (Focal laser)	p-value
Number of Patients	33	32	-
Mean Age (years)	54.8 ± 8.5	55.9 ± 9.1	0.64
Male, n (%)	19 (57.6%)	19 (59.4%)	0.88
Female, n (%)	14 (42.4%)	13 (40.6%)	0.88
PVR Grade C or higher, n (%)	12 (36.4%)	10 (31.3%)	0.68
Duration of Silicone Oil (months)	4.5 ± 0.8	4.3 ± 0.7	0.46
Preoperative BCVA (logMAR)	1.8 ± 0.3	1.9 ± 0.4	0.32

The study showed a significantly lower incidence of retinal redetachment in Group A (360-degree laser retinopexy) compared to Group B (focal laser retinopexy). Only 2 patients (6.1%) in Group A experienced redetachment, whereas 9 patients (28.1%) in Group B had this complication (p = 0.03). These results suggest that 360-degree laser retinopexy is more effective in preventing postoperative redetachment after silicone oil removal.

Table 2: Incidence of Retinal Redetachment

Outcome	Group A (360-degree laser)	Group B (Focal laser)	p-value
Total Patients	33	32	-
Retinal Redetachment, n (%)	2 (6.1%)	9 (28.1%)	0.03*

*Significant difference ($p < 0.05$)

Preoperative BCVA was comparable between the groups (1.8 ± 0.3 vs. 1.9 ± 0.4 logMAR, p = 0.32). However, postoperative BCVA at 12 months was significantly better in Group B(0.8 ± 0.2 logMAR) compared to Group A (1.1 ± 0.3 logMAR, p = 0.04). Additionally, the improvement in BCVA was greater in Group B (1.0 ± 0.2) than in Group A (0.8 ± 0.3, p = 0.02), indicating the superior functional outcomes associated with 360-degree laser retinopexy.

Table 3: Visual Acuity Outcomes

Visual Acuity (BCVA in logMAR)	Group B (360-degree laser)	Group A (Focal laser)	p-value
Preoperative BCVA	1.8 ± 0.3	1.9 ± 0.4	0.32
Postoperative BCVA (12 months)	0.8 ± 0.2	1.1 ± 0.3	0.04*
Improvement in BCVA	1.0 ± 0.2	0.8 ± 0.3	0.02*

*Significant difference ($p < 0.05$)

Proliferative vitreoretinopathy (PVR) Grade C or higher increased the risk of redetachment with an odds ratio (OR) of 3.5 (95% CI: 1.2–9.8, p = 0.02). Focal laser retinopexy (Group B) was associated with a significantly higher risk, with an OR of 5.2 (95% CI: 1.3–20.7, p = 0.01). Additionally, a longer duration of silicone oil tamponade (>6 months) was a significant risk factor, with an OR of 2.8 (95% CI: 1.1–7.3, p = 0.03).

Table 4: Risk Factors for Retinal Redetachment (Logistic Regression Analysis)

Risk Factor	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
PVR Grade C or higher	3.5	1.2–9.8	0.02*
Focal Laser Retinopexy (Group B)	5.2	1.3–20.7	0.01*
Silicone Oil > 6 Months	2.8	1.1–7.3	0.03*

*Significant difference ($p < 0.05$)

Elevated intraocular pressure occurred in 2 patients (6.1%) in Group B and 3 patients (9.4%) in Group A (p = 0.63). Epiretinal membrane formation was noted in 3 patients (9.1%) in Group A and 4 patients (12.5%) in Group B (p = 0.71). Persistent macular edema was slightly more frequent in Group A (15.6%) compared to Group B (6.1%), but this difference was not statistically significant (p = 0.18). 8 patients were phakic in group A and 10 in group B. Out of these 2 in group A and 3 in group B developed cataract

Table 5: Complications Observed Post-ROSO

Complication	Group A (360-degree laser)	Group B (Focal laser)	p-value
Elevated Intraocular Pressure, n (%)	3 (9.4%)	2 (6.1%)	0.63
Epiretinal Membrane Formation, n (%)	3 (9.1%)	4 (12.5%)	0.71
Persistent Macular Edema, n (%)	5 (15.6%)	2 (6.1%)	0.18
Cataract Progression (phakic patients), n (%)	2 (25%)	3 (29.9%)	0.51

Discussion

This study investigated the incidence of retinal redetachment after removal of silicone oil (ROSO) in patients who underwent pars plana vitrectomy (PPV) for rhegmatogenous retinal detachment (RRD), comparing outcomes between those treated with 360-degree laser retinopexy and those who received focal laser retinopexy. The findings highlight several important considerations regarding the role of prophylactic 360-degree laser retinopexy in reducing postoperative complications and improving patient outcomes [11]. The study demonstrated a significantly lower incidence of retinal redetachment in the 360-degree laser retinopexy

group (6.1%) compared to the focal laser retinopexy group (28.1%). These results suggest that 360-degree laser retinopexy provides superior prophylaxis against redetachment by creating a continuous peripheral barrier, effectively addressing potential future sites of retinal breaks [12]. This finding aligns with previous studies that have emphasized the benefits of circumferential laser treatment in complex or high-risk cases of RRD. By preventing new breaks in the peripheral retina, the technique enhances anatomical stability, particularly after the removal of the silicone oil tamponade [13]. Both groups showed significant improvements in best-corrected visual acuity (BCVA) after surgery. However, patients in the 360-degree laser group experienced greater visual improvement, with a mean postoperative BCVA of 0.8 ± 0.2 logMAR compared to 1.1 ± 0.3 logMAR in the focal laser group. This difference may reflect the lower incidence of redetachment and associated complications in the 360-degree laser group [14]. It is also possible that more robust retinal stabilization provided by circumferential laser retinopexy contributed to better functional recovery. The presence of proliferative vitreoretinopathy (PVR), longer silicone oil tamponade duration (>4 months), and the absence of 360-degree laser retinopexy were identified as significant risk factors for retinal redetachment. PVR is well-known as a major predictor of surgical failure, as it leads to excessive tractional forces and recurrent breaks [15]. Similarly, prolonged silicone oil tamponade may contribute to complications such as emulsification and delayed healing, increasing the risk of detachment after ROSO [16].

The significantly higher odds of redetachment in the focal laser group highlight the importance of considering 360-degree laser retinopexy in cases with risk factors such as PVR or extensive retinal pathology [17]. This approach addresses potential future sites of detachment, reducing the likelihood of recurrence and the need for additional surgeries. Postoperative complications were relatively infrequent and comparable between the two groups [18,19]. Elevated intraocular pressure and cataract progression were the most commonly observed issues, consistent with previous studies on silicone oil use. Importantly, 360-degree laser retinopexy did not result in an increased incidence of complications such as macular edema or epiretinal membrane formation, suggesting that the technique is both safe and effective [20].

The results of this study support the use of 360-degree laser retinopexy as a prophylactic measure during PPV for RRD, particularly in patients at higher risk of postoperative complications. This technique offers significant benefits in reducing redetachment rates and improving visual outcomes without adding substantial risk. However, the decision to employ 360-degree laser retinopexy should be individualized, taking into account patient-specific factors such as the extent of retinal detachment, PVR severity, and surgeon expertise [21]. This study has several limitations. First, the retrospective design may introduce selection bias, as patients with more complex retinal detachments may have been more likely to receive 360-degree laser retinopexy. Second, the sample size, while sufficient to detect significant differences, limits the generalizability of the findings to broader populations. Additionally, the study did not evaluate the long-term effects of circumferential laser treatment on peripheral vision, which may be a concern in some patients.

Conclusion

It is concluded that 360-degree laser retinopexy significantly reduces the incidence of retinal redetachment after ROSO in patients undergoing PPV for RRD compared to focal laser retinopexy. This technique provides superior anatomical stabilization and improved visual outcomes, particularly in high-risk cases. Its incorporation into surgical practice can enhance long-term patient outcomes while maintaining safety.

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