Original Article

Effect of adjunctive scleral buckling on the outcomes of pars plana vitrectomy in retinal detachment repair

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ABSTRACT

Background: Rhegmatogenous retinal detachment (RRD) is a sight-threatening condition requiring prompt surgical repair. Pars plana vitrectomy (PPV) and scleral buckling (SB) are standard surgical interventions for RRD, but the added value of combining these treatments is debated. While PPV offers enhanced visualization and safety in complex RRD cases, SB may provide additional support in selected scenarios. However, the impact on functional outcomes, particularly contrast sensitivity (CS), remains unclear. In this study, we compared the anatomical success and visual function, including best-corrected distance visual acuity (BCDVA) and CS, between patients with primary RRD who were treated with PPV alone and those who were treated with combined PPV+SB.

Methods: This comparative cross-sectional study included consecutive patients with primary RRD who were treated at Madinah Teaching Hospital, Faisalabad, Pakistan, from October 2020 to July 2021. Participants underwent either 25-gauge PPV or 25-gauge PPV combined with SB, based on their clinical indications. BCDVA and CS were measured monocularly under standardized photopic conditions using the logarithm of the minimum angle of resolution (logMAR) visual acuity chart and the Pelli–Robson chart, respectively. Anatomical reattachment status was assessed by dilated fundus examination. Postoperative evaluations of BCDVA, CS, and anatomical reattachment rate were conducted at 1 day, 1 month, and 3 months after treatment.

Results: Ninety eyes of 90 patients with primary RRD were included (PPV: n = 45 eyes; PPV + SB: n = 45 eyes). The PPV group was approximately a decade younger (45.2 vs. 55.4 years, $P < 0.05$), while sex distribution was similar in both groups ($P > 0.05$). Anatomical success rates improved over 3 months, reaching 74.0% (n = 33) for PPV versus 62.2% (n = 28) for PPV + SB. PPV achieved significantly better final BCDVA (2.71 vs. 2.84 logMAR, $P < 0.05$). CS increased significantly over time in the PPV group ($P < 0.05$) but remained stable in the PPV + SB group ($P > 0.05$). Although the final CS was significantly higher in the PPV + SB group compared to the PPV group ($P < 0.05$), this difference reflected the higher baseline values in the former group. Overall, PPV alone provided greater anatomical and functional improvement over 3 months than did the combined surgery.

Conclusions: Standalone PPV achieved higher anatomical success rates and greater visual acuity improvement over 3 months than did combined PPV + SB, while CS gains favored PPV + SB, but largely reflected higher baseline values. Despite mixed evidence in the literature, our findings suggested that PPV alone may suffice for treating selected uncomplicated RRD cases. Further large, randomized studies are needed to clarify the optimal surgical approach across different patient and RRD profiles.

KEYWORDS

retinal detachments, vitreoretinal surgeries, vitrectomies, scleral bucklings, visual contrast sensitivity, visual acuities

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How to cite this article: Fatimah M, Nasir A, Abbas Z, Zahra SS, Nasir Z, Javed MM, Nasir K. Effect of adjunctive scleral buckling on the outcomes of pars plana vitrectomy in retinal detachment repair. Med Hypothesis Discov Innov Optom. 2025 Summer; 6(2): 57-64. DOI: https://doi.org/10.51329/mehdioptometry223

Received: 04 June 2025; Accepted: 29 July 2025

INTRODUCTION

The human eye is a specialized neurosensory organ that is composed of three layers: the outer fibrous tunic (comprising the cornea and sclera), the vascular uvea (comprising the iris, ciliary body, and choroid), and the inner neuroretina. Light traverses the aqueous and vitreous media before it reaches the retina, a multilayered structure that is responsible for phototransduction and initial visual processing [1, 2]. Retinal signals are transmitted via retinal ganglion cells through the optic nerve to the brain, enabling visual perception [3].

Rhegmatogenous retinal detachment (RRD) represents a vision-threatening condition that necessitates prompt surgical repair to prevent irreversible vision loss, particularly when giant retinal tears are present. Common surgical interventions for RRD include pars plana vitrectomy (PPV) and scleral buckling (SB) [4, 5]. PPV involves the removal of vitreous gel and the introduction of a tamponade agent to promote retinal reattachment, while SB involves mechanically indenting the sclera by using a silicone band or sponge to relieve vitreoretinal traction [4, 5].

Combining PPV with SB for RRD treatment remains clinically debated. Proponents argue that using adjunctive SB offers additional support by reducing tractional forces and compensating for undetected retinal breaks. Conversely, critics of this approach suggest that SB may increase surgical complexity and could pose risks, such as retinal slippage [6, 7]. The selection of the treatment procedure is often influenced by variables such as break location, lens status, and the presence of proliferative vitreoretinopathy (PVR) [8, 9].

Several studies have evaluated the anatomical and functional outcomes of PPV, SB, or their combination [5, 10-13]. While SB may be advantageous in selected cases, such as those with round retinal holes or less complex detachments, PPV is generally favored for more complicated cases, due to its reproducibility, improved visualization, and favorable safety profile [5, 10-13].

Although visual acuity remains the standard metric for assessing postoperative visual recovery after RRD treatment, it does not always reflect the full extent of visual function. Contrast sensitivity (CS), which is often diminished after retinal detachment surgery, is a critical measure of functional vision and overall quality of life [14-16].

In this study, we compared the anatomical and functional outcomes of using PPV alone versus those of using PPV combined with SB as treatment for patients with primary RRD. By evaluating key parameters, including the retinal reattachment rate, best-corrected distance visual acuity (BCDVA), and CS, this study sought to inform surgical decision-making and enhance visual rehabilitation strategies following RRD repair.

METHODS

This comparative cross-sectional study was carried out at Madinah Teaching Hospital in Faisalabad, Pakistan, from October 2020 to July 2021. Consecutive patients who were diagnosed with RRD were enrolled. The study protocol was approved by the Institutional Review Board of the University of Faisalabad, and written informed consent was obtained from all participants.

We included adults aged > 20 years with a confirmed diagnosis of primary RRD [17]. Patients with coexisting ocular pathologies (other than RRD) or those who were unable to cooperate with the testing protocols were excluded.

All participants underwent a comprehensive ophthalmic evaluation, including anterior segment examination by using a slit-lamp (Carl Zeiss Meditec AG, Jena, Germany). A dilated fundus examination was performed by using an auxiliary lens under slit-lamp biomicroscopy.

BCDVA was assessed monocularly under standardized photopic lighting, using the logarithm of the minimum angle of resolution (logMAR) visual acuity chart (ASF LogMAR Chart LED, Delhi, India) [18] placed at a distance of 4 meters. Participants were instructed to read the chart line-by-line, from top to bottom. The smallest line in which the participant correctly identified all or all but one of the letters (with ≤ 1 error) was recorded as their visual acuity score in logMAR units for analysis. All individuals underwent refraction prior to testing to ensure optimal correction.

CS was measured monocularly under standardized photopic illumination (approximately 85 cd/m^2), by using the Pelli–Robson Contrast Sensitivity Chart (ASF CS Test Chart, Delhi, India) [19, 20] positioned at eye level, 1 meter from the participant. Individuals were instructed to read letters from left to right, from the top, continuing until two or more letters in a triplet were incorrectly identified. The score was recorded as the logarithmic CS (log CS), corresponding to the last correctly read triplet. This testing was performed with the best visual correction in place.

Surgical intervention comprised either 25-gauge PPV [21] or 25-gauge PPV combined with SB [22, 23]. All surgeries were performed by an experienced senior vitreoretinal surgeon following standardized techniques described in the literature [21–23]. The choice of procedure was guided by clinical judgment, with consideration of retinal break characteristics and anatomical complexity. All PPV procedures were conducted under local or peribulbar anesthesia, by using a 25-gauge three-port system. After core vitrectomy, the posterior hyaloid was elevated when still attached, followed by meticulous vitreous base-shaving under scleral depression. Retinal breaks were identified intraoperatively with indirect ophthalmoscopy and were treated with 532-nm laser photocoagulation (200–300 mW, 0.1–0.2 s). Subretinal fluid was drained through the primary break during fluid–air exchange. The choice of tamponade agent was determined by the break location: 14% perfluoropropane (C_3F_8) gas was used for superior breaks, and silicone oil (1000 cSt) for cases with a PVR ≥ Grade B or inferior breaks. In the PPV + SB group, a #240 silicone band was placed circumferentially 2–3-mm posterior to the ora serrata and was secured with 5-0 nylon mattress sutures. Following peritomy, retinal breaks were localized by using scleral depression and indirect ophthalmoscopy. Radial silicone sponges (e.g., 506) were used for anterior breaks. Breaks were treated with transscleral cryopexy (if anterior) or endolaser photocoagulation (if posterior). Subretinal fluid was drained externally via a selected sclerotomy site when indicated. The band was adjusted to achieve approximately 2 mm of scleral indentation. The conjunctiva was closed using 8-0 Vicryl sutures.

Postoperative assessments were scheduled at 1 day, 1 month, and 3 months after treatment by the examiner who performed baseline assessments. During each visit, BCDVA, CS, and the status of anatomical reattachment were documented.

Statistical analysis was performed using IBM SPSS Statistics for Windows, Version 22.0 (IBM Corp., Armonk, NY, USA). Data normality was evaluated with the Shapiro–Wilk test. Categorical variables are presented as frequencies and percentages, while continuous variables are expressed as means and standard deviations (SD). Between-group comparisons of visual outcomes were conducted using independent samples *t*-tests, whereas sex distribution and anatomical success rates were assessed with chi-square tests. Intra-group changes over time were analyzed with repeated measures analysis of variance, and post hoc pairwise comparisons were performed using Bonferroni adjustments, when applicable. A two-tailed *P*-value of < 0.05 was considered statistically significant.

RESULTS

Ninety patients with primary RRD were included and were allocated to the PPV group (n = 45) or the combined PPV + SB group (n = 45). The mean age of patients who underwent PPV alone was significantly younger, by approximately a decade, than that of those treated with PPV + SB ($P < 0.05$). The sex distribution was similar between groups ($P > 0.05$) (Table 1).

The anatomical success rates after PPV improved progressively over time: 54.0% (n = 24) at 1 day, 64.4% (n = 29) at 1 month, and 74.0% (n = 33) at 3 months after treatment. For PPV + SB, the success rates also increased over time, albeit to a lesser extent: 47.0% (n = 21) at 1 day, 60.0% (n = 27) at 1 month, and 62.2% (n = 28) at 3 months after treatment. Overall, PPV alone achieved higher anatomical success rates at each time point than did the combined approach (Table 2).

In the PPV group, the mean (SD) BCDVA improved significantly over the study period: from 2.89 (1.01) logMAR preoperatively and on 1-day postoperatively, to 2.80 (0.94) logMAR at 1-month and 2.71 (1.16) logMAR at 3-months postoperatively ($P < 0.05$) (Table 3). In pairwise comparisons between postoperative time-points, however, differences did not reach statistical significance (all $P > 0.05$). Conversely, in the PPV + SB group, the mean (SD) BCDVA changed only modestly, from 2.96 (0.80) logMAR preoperatively and on 1-day postoperatively to 2.91 (0.76) logMAR at 1-month and 2.84 (0.88) logMAR at 3-months postoperatively, with no statistically significant trend ($P > 0.05$) (Table 3). The final BCDVA at 3 months postoperatively was significantly better in the PPV than in the PPV + SB group ($P < 0.05$) (Table 3).

The PPV group showed a significant increase in CS over time: the mean (SD) remained stable at 1.09 (0.29) log CS from baseline through 1-month postoperatively, then rose to 1.31 (0.47) log CS at 3-months postoperatively ($P < 0.05$) (Table 3). Pairwise comparisons revealed significant differences between preoperative and 3-month, 1-day and 1-month, 1-day and 3-month, and 1-month and 3-month visits (all $P < 0.001$). In contrast, the mean (SD) CS in the PPV + SB group remained largely unchanged: 1.41 (0.50) log CS preoperatively and on 1-day postoperatively, 1.43 (0.50) log CS at 1-month postoperatively, and 1.45 (0.50) log CS at 3-months postoperatively ($P > 0.05$) (Table 3). Although the final mean (SD) CS at 3-months postoperatively was significantly higher in the PPV + SB group (1.45 [0.50] log CS) than in the PPV group (1.31 [0.47] log CS) ($P < 0.05$), this difference may largely have reflected the higher baseline mean CS observed in the PPV + SB group (1.41 [0.50] log CS) than that in the PPV group (1.09 [0.29] log CS) (Table 3).

Table 1. Demographic characteristics of study participants

Variable	PPV (n = 45)	PPV + SB (n = 45)	*P*-value
Age (y), Mean ± SD (Range)	45.2 ± 10.4	55.4 ± 5.0	**< 0.001**
Sex (Men / Women), n (%)	27 (60.3) / 18 (40.2)	27 (60.3) / 18 (40.2)	> 0.99

Abbreviations: y, years; SD, standard deviation; PPV, par plana vitrectomy, SB, scleral buckling; n, numbers; %, percentage. Note: *P*-value < 0.05 is shown in bold.

Table 2. Anatomical success rates in study groups

Time Point	PPV (n = 45)	PPV + SB (n = 45)
Day 1, n (%)	24 (54.0)	21 (47.0)
1-month, n (%)	29 (64.4)	27 (60.0)
3-month, n (%)	33 (74.0)	28 (62.2)

Abbreviations: PPV, par plana vitrectomy, SB, scleral buckling; n, numbers; %, percentage.

Table 3. Best-corrected distance visual acuity and contrast sensitivity across follow-up time-points in the different study groups

Time Point	PPV BCDVA (logMAR) (n = 45)	¹*P*-value	PPV + SB BCDVA (n = 45)	²*P*-value
Preop, Mean ± SD	2.89 ± 1.01	**0.015**	2.96 ± 0.80	0.08
Day 1, Mean ± SD	2.89 ± 1.01		2.96 ± 0.80	
1-month, Mean ± SD	2.80 ± 0.94		2.91 ± 0.76	
3-month, Mean ± SD	2.71 ± 1.16		2.84 ± 0.88	
³*P*-value	**0.019**			
Time Point	**PPV CS (log CS) (n = 45)**	**¹*P*-value**	**PPV + SB CS (log CS) (n = 45)**	**²*P*-value**
Preop, Mean ± SD	1.09 ± 0.29	**0.017**	1.41 ± 0.50	0.37
Day 1, Mean ± SD	1.09 ± 0.29		1.41 ± 0.50	
1-month, Mean ± SD	1.09 ± 0.29		1.43 ± 0.50	
3-month, Mean ± SD	1.31 ± 0.47		1.45 ± 0.50	
³*P*-value	**0.025**			

Abbreviations: BCDVA, best-corrected distance visual acuity; CS, contras sensitivity; SD, standard deviation; PPV, par plana vitrectomy, SB, scleral buckling; n, numbers; %, percentage. Note: *P*-values < 0.05 are shown in bold; ¹*P*-value, comparison of BCDVA or CS at time-points in the PPV group; ²*P*-value, comparison of BCDVA or CS at time-points in the PPV+SB group; ³*P*-value, comparison of BCDVA or CS at 3-months postoperatively between the PPV and PPV+SB groups.

DISSCUSSION

In this prospective comparative study of 90 patients with primary RRD, we found that treatment with PPV alone yielded higher anatomical success rates at all postoperative time points than did treatment with PPV combined with SB. Specifically, PPV yielded a 3-month success rate of 74.0%, as compared to 62.2% with PPV + SB. Visual outcomes also favored treatment with PPV alone: BCDVA improved significantly over the 3-month postoperative period, whereas changes in BCDVA in the PPV + SB group were modest and statistically non-significant. CS increased significantly over time in the PPV group, while remaining stable in the combined treatment group. Although the final CS was higher in the PPV + SB group, this difference reflected baseline disparities rather than postoperative gain.

Echegaray et al. [7] conducted a large retrospective study comparing PPV alone with combined SB and PPV treatment for surgical repair of primary RRD. In 488 cases, the combined SB + PPV procedure showed a significantly higher anatomical success rate after a single surgery than that achieved with PPV alone (92.2% vs. 81.1%), particularly in phakic eyes. Conversely, outcomes were similar between the two methods in pseudophakic eyes with posterior chamber intraocular lenses. A higher single-operation anatomical success rate was linked to better postoperative visual acuity, which underscores the importance of complete reattachment in a single procedure [7]. Stangos et al. [23] conducted a prospective, nonrandomized comparative study involving 71 eyes with primary pseudophakic RRD that were treated with either PPV or PPV + SB. Single-surgery retinal reattachment was achieved in 97.78% of PPV cases and 92.31% of PPV + SB cases. Visual acuity improved by ≥ 3 lines in 60% of PPV- and 69% of PPV + SB-treated eyes. However, treatment with PPV + SB was associated with a greater myopic shift (−1.43 D vs. −0.05 D) and a significantly higher rate of long-term intraocular pressure elevation (34.61% vs. 4.44%) than was treatment with PPV alone. With an average follow-up of 12.45 months, the study concluded that, while PPV is highly effective, the added benefit of including SB for treating pseudophakic RRD remains questionable [23]. Our study demonstrated higher anatomical success rates and better visual outcomes with PPV alone, suggesting that, in selected primary RRD cases, PPV without SB may offer comparable or even superior results, while potentially avoiding additional complications. However, baseline differences in patient age and CS could have influenced outcomes of our study.

In a nationwide, multicenter observational study from the Japan-RD Registry, Koto et al. [24] examined 2775 RRD cases to compare outcomes after SB, PPV, and PPV combined with SB. At 6 months, failure rates, corresponding to increased anatomical damage, were 6.9% for SB, 8.2% for PPV, and 21.3% for PPV + SB. Multivariate analysis showed that PPV was significantly more effective for primary anatomical success in treating simple RRD, particularly in cases with superior retinal breaks (hazard ratio: 3.61). Risk factors for failure included poor initial visual acuity in SB-treated eyes and inferior RRD or large tears in PPV-treated eyes. Despite differences in patient profiles and surgical indications, both SB and PPV achieved comparable overall success rates [24]. Kinori et al. [22] conducted a retrospective, nonrandomized interventional case series involving 181 eyes undergoing surgical repair for noncomplex primary RRD. Single-surgery anatomical success rates were comparable between PPV (81.3%) and PPV + SB (87.1%) groups, with final reattachment rates nearly identical between the groups (98.9% vs. 98.8%, respectively). Visual acuity outcomes were also similar between groups. Subgroup analysis based on tear location and lens status revealed no significant differences in outcomes [22]. The addition of SB to PPV did not confer a measurable benefit and was associated with slightly lower final visual acuity. These findings suggested that adjunctive SB may not be necessary in cases of noncomplex RRD treated with routine PPV [22]. Consistent with these observations, our study similarly demonstrated that PPV alone achieved higher anatomical success rates and resulted in superior visual improvement, supporting its effectiveness as a standalone approach in selected noncomplex primary RRD cases.

Wong et al. [25] assessed outcomes after treating 1530 eyes with primary RRD. Their initial success rate was significantly lower for PPV (78.6%) than for SB (88.8%) or SB + PPV treatment (89.0%). However, the final success rates among all three groups were similar: 97.7% for SB, 95.2% for PPV, and 96.4% for PPV + SB [25]. Functional success rates, based on visual improvement, were higher in the SB group (86.1%) than in the PPV (72.5%) or SB + PPV (77.5%) groups, likely because less-complex RRD cases were included in the SB group [25]. Ryan et al. [26] studied outcomes in moderately complex primary RRD cases and found single-surgery success rates of 91.7% for SB (155/169), 83.1% for PPV (207/249), and 91.2% for combined PPV + SB (271/297). Both SB and PPV + SB treatments fared significantly better than PPV alone in achieving anatomical success after a single surgery [26]. In cases of macula-on or macula-split RRD, SB provided better visual outcomes than did PPV or PPV + SB, even after adjusting for cataract effects [26]. In contrast, our study found higher anatomical success rates and better final visual acuity with PPV alone, underscoring that patient selection and case complexity likely drive these divergent outcomes.

Lee et al. [27] examined surgical outcomes in patients with fovea-sparing RRD who underwent repair within 72 hours of presentation. They found single-operation anatomical success rates of 84% for PPV and 92% for combined PPV+SB, with final reattachment success rates reaching 100% in both groups [27]. Preoperative visual acuity and single-operation anatomical success rates were significantly linked to improved postoperative visual outcomes. The study highlighted the prognostic value of early intervention and suggested that combining SB with PPV could potentially offer anatomical benefits in selected RRD cases [27]. Dayani et al. [28] retrospectively compared outcomes of SB alone with those of SB combined with PPV in macula-off RRD cases without PVR. Both groups achieved similar final visual acuity (median: 20/30) and high anatomical success rates (96.4% for SB vs. 98.4% for PPV + SB) [28]. However, the SB-only group exhibited a significantly higher rate of PVR (15.7% vs. 4.8%) and required more reoperations (21.7% vs. 7.9%). These results imply that adding PPV to SB may reduce postoperative complications in certain macula-off RRD cases [28]. In a retrospective comparative study of pseudophakic eyes with RRD, Setlur et al. [29] found no significant difference in primary anatomical success rates between PPV alone (58/70, 83%) and PPV combined with SB (36/43, 84%). The final success rate reached 100% in both groups, highlighting the effectiveness of both methods as treatments for RRD [29]. Visual acuity improvements depended on macular status; significant gains were observed in macula-off cases across both surgeries, whereas macula-on cases showed smaller, nonsignificant changes. No major complications were reported [29]. In contrast, our findings suggested that PPV alone yielded higher anatomical success rates and better final visual outcomes, particularly in a younger cohort, indicating that patient selection criteria and retinal status are likely explanations for these differences across studies.

In a large multicenter analysis, Dotan et al. [30] reported comparable single-operation anatomical success rates among patients undergoing PPV alone (84.9%), PPV combined with SB (85.5%), or SB alone (84.4%) for primary RRD. These findings suggested that all three surgical approaches may achieve similar reattachment outcomes when appropriately selected based on the clinical context [30]. Halberstadt et al. [31] reported no significant differences in anatomical or functional outcomes between phakic and pseudophakic eyes undergoing primary retinal detachment repair via SB alone or SB combined with PPV [31]. At 6-months postoperatively, the anatomical success rates and BCDVA were comparable across groups, suggesting that lens status may not critically influence the efficacy of these surgical techniques when they are appropriately indicated [31]. Haugstad et al. [32] compared surgical procedures for primary RRD and found comparable primary anatomical success rates among PPV alone (89.0%), PPV combined with SB (87.0%), and SB alone (85.7%). Final anatomical success rates exceeded 98% across all groups, with the PPV+SB group achieving 100% reattachment [32]. Extensive retinal detachment (> 6 clock-hours) and worse baseline Snellen visual acuity were significantly associated with a higher redetachment risk, indicating the relevance of preoperative severity to predicting anatomical outcomes [32]. In a large retrospective series of 751 eyes, Moinuddin et al. [33] reported that PPV was the surgical technique predominantly used for RRD (89.0%), followed by PPV+SB (6.8%) and SB alone (4.2%). The single-surgery anatomical success rates were 91.2% for PPV, 84.3% for PPV+SB, and 93.8% for SB. The final anatomical success rates were similarly high across groups: 96.7% for PPV, 94.1% for PPV+SB, and 100% for SB, highlighting the comparable effectiveness of these approaches when they are appropriately selected [33]. In a multicenter randomized clinical trial involving 211 eyes with pseudophakic or aphakic retinal detachment and PVR grade B or less, Moradian et al. [34] compared the outcomes across four surgical approaches: SB, PPV, PPV combined with SB, and triamcinolone-assisted PPV [34]. All groups demonstrated significant visual improvement from baseline, with no statistically significant differences in their final BCDVA or retinal reattachment rates [34]. However, SB was associated with a significantly faster visual recovery than was PPV+SB at 12 months. The results suggested comparable long-term efficacy across approaches, with SB offering more rapid functional recovery [34]. At 12 months, the reattachment rates were 75% for SB, 64.7% for PPV, 68.5% for PPV+SB, and 66.7% for triamcinolone-assisted PPV. No significant differences were noted among the groups regarding reattachment rates or adverse events [34]. In a retrospective consecutive case series of 565 eyes with medium-complexity RRD, Rush et al. [35] compared the anatomical and visual outcomes of PPV, SB, and PPV+SB. At the six-month follow-up, the overall primary anatomical success rate was 83.6%, with no statistically significant differences among the three approaches in achieving anatomical reattachment or a BCDVA of 20/40 or better [35]. Combined PPV+SB was more frequently selected for complex cases involving multiple or inferior breaks; nevertheless, it demonstrated the highest overall anatomical success rate, suggesting its utility in managing more challenging RRD presentations [35]. A macula-off status and postoperative PVR were associated with worse visual outcomes [35]. In contrast, our study found that PPV alone outperformed combined PPV+SB in terms of anatomical success rates and visual improvement, indicating that, in less-complex, younger patient populations, the standalone PPV approach may yield superior results.

Tewari et al. [36] compared SB and combined PPV+SB for the management of uncomplicated primary RRD with unseen retinal breaks [36]. At the three-month follow-up, the primary reattachment rates were comparable between the two groups: 80% (16/20) for PPV+SB and 70% (14/20) for SB alone [36]. Both groups showed significant postoperative improvement in visual acuity as compared to baseline, with no statistically significant difference between them [36]. However, the number of intraoperative and postoperative complications was higher in the combined surgery group [36]. The study concluded that conventional SB remains a safe and effective option for managing uncomplicated RRD with unseen breaks in cases with clear media [36]. Schaal et al. [37] analyzed the outcomes from 1226 patients undergoing primary repair of RRD: 322 underwent SB, 442 underwent PPV, 316 underwent combined PPV + SB, and 56 underwent pneumatic retinopexy [37]. The initial reattachment rates were 86% for SB, 90% for PPV, 94% for PPV + SB, and 63% for pneumatic retinopexy [37]. While pneumatic retinopexy had a significantly lower initial success rate, the initial reattachment rate did not differ significantly among the SB, PPV, and PPV + SB groups [37]. At 1-year postoperatively, the final visual acuity was similar across all surgical groups. Complication profiles varied, but the study concluded that SB, PPV, and PPV + SB provided superior initial anatomical success and required fewer additional procedures than did pneumatic retinopexy [37]. Baba et al. [38] observed better postoperative BCDVA in patients with RRD who were treated with PPV. Nonetheless, without concurrent cataract surgery, the proportion of patients reaching a BCDVA of 20/25 was similar between their PPV and SB groups [38]. In contrast, our study demonstrated that PPV alone yielded significantly better anatomical success rates and visual outcomes than did combined PPV+SB, particularly in a younger patient cohort with primary RRD.

Despite extensive research, no clear consensus has been reached on whether PPV alone or PPV combined with SB is superior. The literature reports mixed results: some studies have favored PPV alone for better success rates [7, 22, 23, 24, 29], while others have reported achieving better outcomes with adjunctive SB [25-27]. Interestingly, several studies found no significant difference in success rates between the methods [30-38]. These discrepancies likely stem from variations in patient selection, surgical skill, case complexity, or the definition of success [7, 22-38]. This emphasizes the need for more controlled research to identify the optimal surgical technique for different clinical situations. In contrast to prior reports that showed either comparable outcomes between PPV and PPV + SB [30–38] or superiority of adjunctive SB in selected scenarios [25–27], our study demonstrated that PPV alone achieved higher anatomical success rates and greater visual improvement than did combined PPV + SB, particularly in younger patients with primary RRD. These findings suggested that, when appropriately selected, standalone PPV may offer distinct advantages over combined procedures, underscoring the importance of individualized surgical planning, rather than routinely using adjunctive buckling.

This study's strengths include a prospective design, use of standardized surgical techniques by a single experienced surgeon, and detailed longitudinal assessment of both anatomical and functional outcomes. However, its modest sample size, nonrandomized patient allocation, and limited follow-up duration may constrain the generalizability of the results, particularly as compared to those of larger, multicenter series. Moreover, baseline differences in patient age and CS could have influenced outcomes. While our findings indicate that standalone PPV may be superior for selected primary RRD cases, definitive conclusions remain limited by the abovementioned factors. Future randomized controlled trials with larger cohorts, stratified by lens status, macular involvement, and case complexity, are warranted to clarify in which situations adjunctive SB adds value, thereby guiding tailored surgical strategies in contemporary vitreoretinal practice.

CONCLUSIONS

In this prospective study that compared primary RRD repair techniques, the anatomical success rates were higher and improvement in BCDVA was greater over 3 months with standalone PPV treatment than with combined PPV + SB treatment. While CS gains favored PPV + SB treatment, this largely reflected higher baseline values. Despite the extensive literature available, no consensus regarding the superior technique has been reached, as outcomes appear to depend on case complexity, surgeon preference, and patient characteristics. Our findings suggested that PPV alone may suffice for selected uncomplicated cases. Larger randomized trials, employing stratification by macular status, lens status, and break location, are needed to better define the optimal surgical approach for diverse clinical scenarios.

ETHICAL DECLARATIONS

Ethical approval: The study protocol was approved by the Institutional Review Board of the University of Faisalabad, and written informed consent was obtained from all participants.

Conflict of interests: None.

FUNDING

None.

ACKNOWLEDGMENTS

The authors would like to thank the staff of Madinah Teaching Hospital and the University of Faisalabad for their support in facilitating patient access and in data collection during this study.

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