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Surgical Outcomes of Primary Noncomplex Rhegmatogenous Retinal Detachment in 20- to 45-Year-Old Young Adults

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Abstract

Purpose: To analyze anatomic and visual outcomes of young adults with uncomplicated primary rhegmatogenous retinal detachment (RRD) treated with scleral buckle, pars plana vitrectomy (PPV), or combined PPV and scleral buckle. **Methods:** Patients included in the Primary Retinal Detachment Outcomes study with a minimum of 6 months follow-up were evaluated in this multicenter interventional cohort study. Patients with complex RRDs were excluded. Primary outcomes were single surgery anatomic success and final visual acuity (VA). **Results:** Scleral buckle was performed in 91 eyes (55%), PPV in 32 (19%), and combined PPV and scleral buckle in 42 (25%). Single surgery anatomic success rates were 79.3% for PPV alone, 83.7% for primary scleral buckle, and 92.7% for combined PPV and scleral buckle (analysis of variance, $P = .25$). When adjusting for potential risk factors, eyes that had PPV alone were more likely to redetach compared with those that had combined PPV and scleral buckle (hazard ratio [HR], 7.24, 95% CI, 1.25-42.1; $P = .03$), while rates of redetachment were similar in eyes that had scleral buckle alone and combined PPV and scleral buckle (HR, 3.24, 95% CI, 0.63-16.63; $P = .16$). However, eyes that had combined PPV and scleral buckle were less likely to result in good vision compared with eyes that had scleral buckle alone (odds ratio [OR], 0.26, 95% CI, 0.07-0.94; $P = .04$). Similarly, eyes that had PPV alone were less likely to obtain good vision compared with eyes that only had scleral buckle (OR, 0.20, 95% CI, 0.05-0.81; $P = .02$). **Conclusions:** For young adults in this study, the best visual outcomes resulted from scleral buckle, and a higher single surgery success rate was found with combined PPV and scleral buckle.

Keywords

retina, rhegmatogenous retinal detachment, scleral buckle, pars plana vitrectomy, young adults

Introduction

Rhegmatogenous retinal detachment (RRD) is the most common type of RD and a major cause of vision loss.[1,2] Decreased vision can negatively impact self-perception, education, job opportunities, and many other social factors. However, continually evolving techniques and instrumentation have led to improved surgical outcomes.[2] Single surgical anatomic success and other outcomes for adult and pediatric primary RRD have been well described in the literature, but data regarding patients in the intermediate age range (ie, 20-45 years) have been limited.[3–6] Recently, a small study from Israel examined anatomic and functional outcomes in young adults aged 18 to 40 undergoing scleral buckle, pars plana vitrectomy (PPV), or combined PPV and scleral buckle. The best visual outcomes were found with scleral buckle, while anatomic success rates were similar between the 3 groups.[7] Another larger study of pediatric plus younger adult Japanese patients, with a range of 2 to 49 years, showed similar results.[8]

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In older adults, many studies have shown overall similar single surgical anatomic success rates among scleral buckle, PPV, and combined PPV and scleral buckle.[3,9–13] A large meta-analysis showed that there was no difference in the single operation reattachment rate between scleral buckle and PPV with or without scleral buckle for phakic or pseudophakic patients.[10] However, certain patient characteristics may favor 1 surgery type over another. PPV can be an effective option in older adults because they are more likely to be pseudophakic, have a complete posterior vitreous detachment (PVD), and a less adherent posterior hyaloid.[14] This facilitates a more complete removal of the vitreous and associated traction and decreases the risk of iatrogenic retinal breaks.[14] Scleral buckle performed alone is still an effective option in older adults or in combination with PPV. Many benefits are provided, including offering support to the vitreous base to counteract tractional forces of proliferative vitreoretinopathy (PVR), and the rate of cataract formation in phakic patients is not affected.[13,15,16] However, there are also studies that argue for superiority of 1 surgical type over the others. In the Primary Retinal Detachment Outcomes study, of which this paper is a subgroup analysis, phakic adults with RRD had superior single surgery success and visual outcomes when treated with scleral buckle alone.[17] Likewise, pseudophakic adults had better single surgery success with combined PPV and scleral buckle compared with PPV alone, but visual outcomes were similar.[18] In patients with RRD who are older than the average adult, the addition of a scleral buckle may confer additional benefits.[19]

The management of pediatric RRDs has been well described and differs significantly from that of RRDs in adults.[20] Scleral buckle is generally preferred to PPV in children because young patients will have a highly adherent posterior hyaloidal face that can make complete hyaloidal separation with PPV challenging and, at times, impossible.[14] PVR can also be relentless in children, especially in the setting of failed vitrectomies.[21,22] Last, postoperative positioning is important for surgical success for patients undergoing vitrectomy, and pediatric patients may struggle to adhere to these directions. These are some of the factors that favor scleral buckle or combined PPV and scleral buckle as the surgery of choice in pediatric patients. However, despite the better outcomes, the use of scleral buckle in children is not universally performed in the United States.[23]

RRD repair in adults and children has been studied in great detail; however, surgical outcomes and characteristics in young adults are not well described. With such differing surgical considerations and approaches between these populations, surgical planning can be complex. The purpose of the current study is to better characterize the preoperative characteristics and surgical outcomes for young adults with RRDs repaired with scleral buckle, PPV, or combined PPV and scleral buckle among centers that routinely perform all 3 techniques.

Methods

Data Extraction

This study complied with the Health Insurance Portability and Accountability Act, received approval from all institutional review board sites, and adhered to the tenets of the Declaration of Helsinki. Ethical approval for this study was obtained from Wills Eye Hospital IRB (assurance ID: FWA00001933). This is a subgroup analysis from the Primary Retinal Detachment Outcomes Study, which has been previously described in detail.[9,17,24] Detailed demographic, preoperative, and outcome metrics were collected retrospectively from each site using a secure online Research Electronic Data Capture database. Informed consent was not required from study participants.

Outcome Assessment

The primary outcomes were single surgery anatomic success, defined as retinal attachment without subsequent surgery needed for RD, and best-corrected visual acuity (BCVA) based on testing with pinhole or habitual correction. VA was dichotomized as 20/40 and better versus worse than 20/40. Secondary outcomes included final retinal attachment (with 1 or more surgeries), complications, and postoperative development of cataracts.

Inclusion and Exclusion Criteria

For the current study, we analyzed the baseline characteristics, surgical techniques, and various outcomes of RRD repair in young adults aged 20 to 45 years who underwent scleral buckle, PPV, or combined PPV and scleral buckle for repair of primary RRD from January 1, 2015, to December 31, 2015, at VitreoRetinal Surgery in Minneapolis, The Retina Center in Minneapolis, The Retina Institute in St. Louis, Associated Retinal Consultants/William Beaumont Hospital in Detroit, Massachusetts Eye & Ear in Boston, and Mid Atlantic Retina/Wills Eye Hospital in Philadelphia. All patients were followed postoperatively for at least 6 months.

Exclusionary criteria were eyes with less than 6 months of follow-up, eyes with tractional and posttraumatic RDs, and eyes with RDs managed with pneumatic retinopexy, in-office laser, or cryoretinopexy. Eyes with complex RRDs, defined as RRDs associated with any degree of PVR,[25] vitreous hemorrhage (VH), choroidal detachment, Marfan syndrome, Stickler syndrome, giant retinal tears, and retinopathy of prematurity (both diagnosis of, and previously treated), were also excluded. Eyes with confounding factors such as those with concurrent age-related macular degeneration, macular hole, epiretinal membrane, amblyopia, and optic neuropathy were also excluded. The presence or absence of a PVD was based on the operative note. If the operative note did not mention the hyaloid status, the findings were recorded in the preoperative clinical note, which was based on the clinical examination, aided by optical coherence tomography at the discretion of the surgeon.

Statistical Analyses

Continuous variables were presented with mean and SD and compared between the 3 different surgical modalities using Kruskal-Wallis test for non-normally distributed continuous variables or 1-way analysis of variance testing for normally distributed continuous variables. Categorical variables were presented with frequency and percentage and compared between the 2 groups using χ^2 test or Fisher exact test if the cell count was less than 10. For analysis, Snellen VA was converted to logMAR units.

Multivariable Cox proportional hazard models were used to estimate the effects of surgical modality on surgery failure after adjusting for other potential confounding factors. The assumption of proportional hazard was examined by visual inspection of log(-log) survival plots. Multivariable logistic regression analysis was conducted for the primary outcome of good vision because this outcome did not satisfy the assumption of proportional hazard.

A multivariable linear regression model was fitted to identify the effect of surgical modality, demographic information, and clinical risk factors on postoperative VA at final follow-up. Normality check was performed for the model residuals to ensure that the normality assumption held for linear models. Multivariable logistic regression models were fitted to identify the effect of surgical modality for secondary outcomes (cataract progression and complications).

To better interpret the results, redetachment was defined as requiring a second operation for RRD and was used as a dependent variable in logistic regression analyses. All statistical analyses were performed with SAS software (version 9.4, SAS Institute Inc). Statistical significance was set at $P < .05$.

Results

Patient Demographics and Preoperative Characteristics

One hundred and sixty-five eyes of an initial 260 cases met the inclusion criteria. Scleral buckle was performed in 91 eyes (55%), PPV in 32 eyes (19%), and combined PPV and scleral buckle in 42 eyes (25%). The median age of the entire group was 37 years. The scleral buckle group had a median age of 33 years vs 41 years for the PPV group and 39.5 years for the combined PPV and scleral buckle group, respectively ($P < .0001$). The median follow-up in days was 364 (range, 291-496), with the combined PPV and scleral buckle group having the longest follow-up ($P = .06$). Fifty-two percent of patients were women. There were no differences in gender, operative eye, and personal or family history of RD among surgical modalities. All eyes that had primary scleral buckle performed were phakic, while 64% and 72% of eyes that had PPV and combined PPV and scleral buckle were pseudophakic, respectively.

Eyes that had scleral buckle performed were more likely to have a better preoperative logMAR VA, with a median of 0.18 (20/1262) and an interquartile range (IQR) of 0 (20/20) to 0.48 (20/60) for scleral buckle surgery, a median of 0.35 (20/45) and an IQR of 0.05 (20/22) to 1.15 (20/283) for PPV, and a median of 0.30 (20/40) and an IQR of 0.10 (20/25) to 1.3 (20/400) for combined PPV and scleral buckle ($P = .02$). The greatest frequency of lattice was identified preoperatively in patients who had scleral buckle (75.4%, $P = .003$) and all were phakic ($P < .0001$). No previous ocular surgery had been performed in eyes with scleral buckle. Eyes that had PPV or combined PPV and scleral buckle were more likely to have PVD (PPV, 43.5%, combined PPV and scleral buckle, 53.1%, scleral buckle, 22.2%; $P = .007$) and be pseudophakic (PPV, 17.4%, combined PPV and scleral buckle, 31.3%, scleral buckle, 0%; $P < .001$). A full list of demographic and preoperative metrics is found in Table 1.

Primary Surgical Outcomes

The overall single surgery anatomic success rate was 85.3% for all eyes. A trend for lower success was found in eyes that had PPV alone compared with those managed with primary scleral buckle and combined PPV and scleral buckle, but the differences did not reach statistical significance (79.3% for PPV, 83.7% for scleral buckle, 92.7% for combined PPV and scleral buckle; $P = .25$). The final retinal reattachment rate was 97.4% for all eyes, with similar results among all surgical modalities (97.7% for scleral buckle, 96.6% for PPV, 97.6% for combined PPV and scleral buckle; $P = .95$). In patients with primary scleral buckle, the median follow-up was 338 days. The median postoperative logMAR VA was 0.10 (20/25) with an IQR of 0 (20/20) to 0.30 (20/40) compared with the median preoperative logMAR VA of 0.18 (20/30) and an IQR of 0 (20/20) to 0.48 (20/60). Without controlling for potential confounders, eyes that had scleral buckle had a better median postoperative VA, 0.10 (20/25), and an IQR of 0 (20/20) to 0.3. The median postoperative VA for eyes that had PPV was 0.18 (20/30) with an IQR of 0 (20/20) to 1.3 (20/400), and for combined PPV and scleral buckle was 0.18 (20/30) with an IQR of 0.10 (20/25) to 0.88 (20/152) ($P = .02$).

The rate of complications, including persistent cystoid macular edema, VH, strabismus, choroidal hemorrhage, lens touch, iatrogenic breaks, hemorrhage from drainage sites, suture perforations, or retinal incarceration, were 8.1% for eyes that had scleral buckle, 3.5% for PPV, and 2.4% for combined PPV and scleral buckle, but these differences were not statistically significant ($P = .366$). P values show a raw comparison of clinical outcomes among the 3 surgery modalities (Table 2). For eyes that had PPV alone, 46.9% received sulfur hexafluoride (SF_6) as tamponade, 50.0% had perfluoropropane (C_3F_8), and 3.1% had silicone oil (SO). For those eyes that had combined PPV and scleral buckle, 35.7% received SF_6, 50.0% C_3F_8, and 7.1% SO. The form of tamponade was not recorded in 3 eyes.

Identifying Risk Factors for Redetachment and Worse Postoperative Vision

Adjusted hazard ratios (HR) from multivariable Cox proportional hazard regression analysis showed that PPV alone had a higher risk of redetachment after adjusting for age, gender, clinical evidence of PVD, preoperative logMAR VA, preoperative lens status, and presence of lattice degeneration compared with combined PPV and scleral buckle (HR, 8.22, 95% CI, 1.33-50.54) (Table 3).

Multiple preoperative metrics were found to be independently predictive of postoperative logMAR VA. A multivariable

Table 1. Characteristics of Patients Undergoing Primary Repair for Uncomplicated RRD, Stratified By Surgical Modality.

Variable	All (N = 165)	SB (n = 91)	PPV (n = 32)	SB/PPV (n = 42)	*P* Value[a]
Male sex, n (%)	80 (48.5)	37 (40.7)	20 (62.5)	23 (54.8)	.067
Median age (IQR), y	37 (30–41)	33 (27–39)	41 (38.5–43)	39.5 (35–44)	<.0001
Median follow-up length, d (IQR)	364 (291–496)	338 (277–482)	379.5 (286–488)	442 (331–543)	.055
Left eye, n (%)	87 (52.7)	50 (55)	15 (46.9)	22 (52.4)	.733
History of RD in fellow eye, n (%)	17 (10.3)	9 (9.9)	1 (3.1)	7 (16.7)	.169
Family history of RD, n (%)	14 (8.5)	6 (6.6)	6 (18.8)	2 (4.8)	.167
Median preoperative logMAR VA with Snellen equivalents, IQR	0.18 (20/30) [0 (20/20) – 0.70 (20/100)]	0.18 (20/30) [0 (20/20) – 0.48 (20/60)]	0.35 (20/45) [0.05 (20/22) – 1.15 (20/283)]	0.30 (20/40) [0.10 (20/25) – 1.3 (20/400)]	.02
Preoperative myopia>-5 diopters, n (%)	48 (58.5)	35 (58.3)	5 (71.4)	8 (53.3)	.754
Total	N = 82	n = 60	n = 7	n = 15	
Clinical evidence of a PVD, n (%)	41 (34.8)	14 (22.2)	10 (43.5)	17 (53.1)	.007
Total	N = 118	n = 63	n = 23	n = 32	
Preoperative lens status, n (%)					<.0001
Aphakic	3 (2)	0 (0)	2 (7)	1 (3)	
Phakic	131 (86)	85 (100)	18 (64)	28 (72)	
Pseudophakic	18 (12)	0 (0)	8 (29)	10 (26)	
Total	N = 152	n = 85	n = 28	n = 39	
Preoperative lattice,n (%)	73 (62.9%)	52 (75.4)	8 (40)	13 (48.1)	.003
Total	N = 116	n = 69	n = 20	n = 27	
Preoperative macular attachment, n (%)	105 (64.4)	60 (67.4)	20 (62.5)	25 (59.5)	.657
Total	N = 163	n = 89	n = 32	n = 42	
Presence of retinal dialysis, n (%)	5 (7.7)	5 (12.8)	0 (0)	0 (0)	.265
Total	N = 65	n = 39	n = 15	n = 11	
Extent of RD >6 clock hours, n (%)	19 (11.5)	7 (7.7)	6 (18.8)	6 (14.3)	.170
Total	N = 165	n = 91	n = 32	n = 42	

Abbreviations: PPV, pars plana vitrectomy; PVD, posterior vitreous detachment; PVR, proliferative vitreoretinopathy; RD, retinal detachment; SB, scleral buckle; VA, visual acuity.

[a]Represents statistically significant difference between surgical modalities using χ^2 test or Fisher exact test for categorical variables, Kruskal-Wallis for non-normally distributed continuous variables, or 1-way analysis of variance for normally distributed continuous variables.

Table 2. Clinical Outcomes of Patients Undergoing Primary Repair of Uncomplicated RRD, Stratified By Surgical Modality.

Variable	All (N = 165)	SB (n = 91)	PPV (n = 32)	PPV/SB (n = 42)	*P* Value[a]
Single surgery success, n (%)	133 (85.3)	72 (83.7)	23 (79.3)	38 (92.7)	.250
Total	N = 156	n = 86	n = 29	n = 41	
Median postoperative logMAR VA with Snellen equivalents, IQR	0.18 (20/30) [0 (20/20) – 0.48 (20/60)]	0.10 (20/25) [0 (20/20) – 0.30 (20/40)]	0.18 [20/30) [0 (20/20) – 1.3 (20/400)]	0.18 (20/30) [0.10 (20/25) – 0.88 (20/152)]	.02
Cataract progression, n (%)	49 (38.3)	20 (24.1)	12 (70.6)	17 (60.7)	<.0001
Total	N = 128	n = 83	n = 17	n = 28	
Final postoperative retina attachment, n (%)	152 (97.4)	84 (97.7)	28 (96.6)	40 (97.6)	.95
Total	N = 156	n = 86	n = 29	n = 41	

Abbreviations: SB, scleral buckle; PPV, pars plana vitrectomy; RRD, rhegmatogenous retinal detachment; VA, visual acuity.
[a]Represents statistically significant difference between surgical modalities using χ^2 test or Fisher exact test for categorical variables, Kruskal-Wallis for non-normally distributed continuous variables, or 1-way analysis of variance for normally distributed continuous variables.

Table 3. Comparison of Redetachment Rates Between Surgical Modalities.

Modality	Adjusted Hazard Ratio	95% CI		P Value
		Lower bound	Upper bound	
SB vs SB/PPV	4.08	0.66	25.17	.16
PPV vs SB/PPV	8.22	1.33	50.54	.02

Abbreviations: PPV, pars plana vitrectomy; PVD, posterior vitreous detachment; SB, scleral buckle. Other potential confounding factors adjusted in this model include age, gender, clinical evidence of a PVD, preoperative logMAR, presence of lattice degeneration, and lens status.

Table 4. Adjusted Odds Ratios Between Surgical Modalities for Achieving Improved Vision (20/40) (c statistics = 0.79).

Variables	Odds Ratio	95% CI		P Value
		Lower bound	Upper bound	
SB/PPV vs SB	0.26	0.07	0.94	.04
PPV vs SB	0.20	0.05	0.81	.02
Male vs female	2.54	0.86	7.52	.09
Preoperative logMAR	0.30	0.15	0.57	.0003
Older age (per 10 years)	1.91	0.87	4.21	.11

Abbreviations: PPV, pars plana vitrectomy; SB, scleral buckle.

linear regression model (Supplementary Table 1) with postoperative logMAR VA as the outcome showed that PPV alone ($\beta \pm$ SE, 0.47 $\pm$ 0.14; $P = .0008$) or combined PPV and scleral buckle ($\beta \pm$ SE, 0.29 $\pm$ 0.12; $P = .03$) was associated with a worse postoperative logMAR VA. Having a worse initial logMAR VA was associated with worse postoperative logMAR VA ($\beta \pm$ SE, 0.34 $\pm$ 0.07; $P < .0001$). Older patients had better postoperative logMAR VA ($\beta \pm$ SE, -0.18 $\pm$ 0.06 for every decade; $P = .01$).

Associations Between Surgical Modality and Secondary Outcomes

The associations between surgical modality and the 2 secondary outcomes, cataract progression and complications, are shown in Supplemental Table 2. Both PPV alone (OR, 4.53, 95% CI, 1.25-16.38; $P = .02$) and combined PPV and scleral buckle (OR, 3.18, 95% CI, 1.00-10.10; $P = .05$) carried a significantly higher risk of cataract progression compared with scleral buckle alone. No significant differences among surgical modalities were observed in complications.

Conclusions

Although published studies regarding pediatric and adult RRD surgery continue to rapidly expand, we still have very little peer-reviewed published data for young adults. This multicenter interventional retrospective cohort study analyzed 165 eyes of patients between the ages of 20 and 45 years with primary uncomplicated RRD and compared the surgical outcomes of the 3 surgical modalities. There is no universal definition for "young adult," but we chose age 20 years as the lower end of the age range because there is ample literature on pediatric RRD that includes teenagers. The upper end of 45 years was chosen because the adult RRD literature typically has higher incidences starting from age 50 due to PVD-related RRDs. Therefore, by examining 20- to 45-year-olds, we hoped to capture the age range with the biggest gap in the RD literature. The single surgery anatomic success rate was 85.3% for all eyes. Success rates among the 3 modalities did not show significant differences, with better postoperative VA found in eyes that had scleral buckle compared with the other 2 techniques. Regression analysis showed that after adjusting for various factors, including preoperative VA, PPV alone had a significantly higher risk of redetachment compared with combined surgery.

A recent study in 2020 by Ryan et al[17] that examined single surgery anatomic success in a cohort of adult phakic patients with primary RRD reported similar results, showing that scleral buckle (91.7%) and combined PPV and scleral buckle (91.2%) had superior success rates compared with PPV alone (83.1%) ($P = .00041$). However, this study excluded those patients aged less than 40 years old due to bias toward scleral buckle placement and included adults older than those in this current study. A previous small study by Brown et al[26] evaluated RRD in 38 eyes of young adults aged 18 to 30 years old who had primary RRD with some exclusions, including trauma, inflammatory disease, and retinal vascular disease. They performed scleral buckle alone in 27 of 38 eyes (71%) and combined PPV and scleral buckle in 11 eyes (29%), which is similar to this study of 91 of 165 (55%) eyes that had scleral buckle and 42 of 165 (25%) eyes that had combined surgery. PPV alone was not considered an option due to the lack of PVD in the patients' young age group. Their surgical success rates were 74% for scleral buckle alone ($N = 20$) and 64% for combined surgery ($N = 7$).[26] The preference for scleral buckle in the study was consistent with their younger age group, whereas PPV is more commonly used for older patients.

The next significant finding from the current study was that, compared with patients having PPV alone and combined PPV and scleral buckle, patients that had scleral buckle had the best final median postoperative VA. Similarly, a recent publication showed that in young adults aged 18 to 40 undergoing scleral buckle, PPV, or combined PPV and scleral buckle for RRD, anatomic success rates were similar between the 3 groups ($P = .9$), but scleral buckle had the best preoperative ($P = .027$) and postoperative VA ($P < .0001$).[27] This is possibly due to the fact that the majority of patients undergoing scleral buckle had macula-on RRD (80%) compared with PPV alone (20%) and combined PPV and scleral buckle (46%), as well as the fact that less complicated cases were more likely to be chosen for scleral buckle (ie, early PVR stages, single or small breaks) than primary PPV or combined surgery, which could have contributed to the scleral buckle group's highest postoperative VA. In the current study, these confounding factors were either excluded or controlled for in our regression models but still yielded similar results, further emphasizing the importance of considering scleral buckles in young adults.

Preoperative logMAR VA was the only other significant variable that increased the likelihood of achieving improved postoperative VA when adjusting for surgical modality, age, and gender (Table 4) ($P = .0003$). A study by Marques et al[28] of 89 eyes from young adults aged 18 to 40 who had scleral buckle, PPV, or combined PPV and scleral buckle for primary RRD showed that better postoperative VA was associated with localized RRD ($P = .007$) and attached macula at presentation ($P < .001$), which is expected. Another study in young Japanese patients with an average age of 33 years, age range 2 to 49 years old, who had scleral buckle or PPV showed similar results; there were almost no differences in anatomic outcomes, and the scleral buckle group had better preoperative ($P = .0001$) and postoperative VA ($P = .0001$) than their counterparts who had PPV alone.[8] That study also found that better BCVA was achieved in younger patients and patients with macula-on RRDs; negative predictors on final BCVA were male sex and patients who experienced surgical complications.[8]

Our study found macula status ($P = .66$) and RD extent ($P = 0.17$) to be similar among the 3 surgical modalities ($P = 0.66$) and were not included in the logistic regression for postoperative VA outcomes (Table 4). This speaks to the less biased nature of our cohort. Finally, it is well-documented in the literature that PPV leads to accelerated cataract formation, which is likely to negatively impact postoperative VA in phakic patients.[29] In our study, 70% of patients who had PPV developed cataracts by final follow-up (Table 2, $P < .0001$), and PPV ($P = 0.02$) and combined PPV and scleral buckle were both significantly more likely to result in cataract progression compared with SB alone ($P = .05$) (Supplementary Table 2).

A retrospective study of 111 eyes from young adult French patients who had scleral buckle or PPV for primary RRD showed that high myopia was a risk for surgical failure ($P < .01$), with a surgical success rate of 69.6% for scleral buckle and 62.2% for PPV.[7] However, the study did not conduct any analyses comparing different outcomes between those 2 groups. In our study, the PPV group had the greatest rates of high myopes (70%); when compared with those in the scleral buckle and combined PPV and scleral buckle groups, no statistical difference was found ($P = .754$) and was not included in the Cox proportional hazard model for redetachment.

We analyzed an extensive, well-documented database of consecutive cases of RD at 5 major retinal practices in the US with surgeons who were skilled in all 3 surgical approaches. The definition of young adults may be debated, but we felt our choice was reflective of a population with unique features rarely addressed in the literature. The data presented are retrospective and were collected across many institutions, including surgeons with different surgical preferences and techniques, which introduces intraoperative and postoperative biases, such as choice of surgery, intraoperative surgical approaches (eg, instrument gauge, degree of vitreous removal, addition of scleral buckle, tamponade agent, etc) and postoperative management (eg, positioning). A greater sample and prospective design would confer more power to the findings. However, large prospective surgical studies are extremely costly and time consuming. In the absence of a prospective clinical trial, the best alternative was this large and detailed database of consecutive cases from institutions and surgeons comfortable with both scleral buckle and PPV techniques. The nature of studies like ours inherently reflects the variability in surgical decision-making. The follow-up for all eyes was at least 6 months with a median of 364 days, or approximately 1 year. Longer follow-up could offer additional clinical insight into the durability of individual single surgical anatomic success rates.

In summary, for primary uncomplicated RRD among the young adult population, we found that scleral buckle, PPV, and combined PPV and scleral buckle have comparably high single surgery anatomic success rates. However, after secondary analysis, combined PPV and scleral buckle was found to have the lowest risk of redetachment, reaching statistical significance when compared with PPV alone. Overall, the majority of eyes went on to achieve a final VA of 20/40 or better. Primary scleral buckle had the best final VA, outperforming PPV even when controlling for preoperative VA. Our data suggest that for young adults, consideration of primary scleral buckle or combined PPV and scleral buckle may confer superior results compared with PPV alone, although individual patient characteristics need to be considered.

Ethical Approval

This study complied with the Health Insurance Portability and Accountability Act of 1996, received approval from all institutional review board (IRB) sites, and adhered to the tenets of the Declaration of Helsinki. Ethical approval for this study was obtained from Wills Eye Hospital IRB (assurance ID: FWA00001933).

Statement of Informed Consent

Due to the retrospective nature of this study, informed consent was not required from participants.

Declaration of Conflicting Interests

The authors declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article:

Drs. Ryan, Gupta, Eliott, and Yonekawa are consultants to Alcon.
Dr. Eliott is a consultant to Dutch Ophthalmic and Genentech; is a science advisory board member of Pykus Therapeutics; and holds stock in Aldeyra Therapeutics.
Dr. Capone is a consultant to Ohr Pharmaceuticals and Spark Therapeutics; receives grant support from Alcon, Aura Biosciences, Genentech, Iconic Therapeutics, Ohr Pharmaceuticals, Otsuka Pharmaceutical Co, and ThromboGenics, Inc; is an equity owner in Broadspot, an equity owner and recipient of patent royalties from Caeregen and InterVIEW, and an equity owner in Neolight.
Dr. Regillo is a consultant to Adverum, Aldeyra, Allergan, Allegro, Biotime, Chengdu Kanghong, Graybug, Kodiak, Merck, Notal, Novartis, Opthea, Santen, and Shire-Takeda; and receives grant support from Adverum, Allergan, Astellas, Chengdu, Genentech, Kanghong, Notal, Novartis, Opthea, Ophthotech, and Regeneron.
Dr. Emerson is a principal investigator for Genentech; and holds stock in Allergan, Celgene, Envision, Gilead, Glaukos, Mallinckrodt, Novartis, Ocular Therapeutix, Pfizer, pSivida, Regeneron, REGNXBIO, and Valiant.
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Supplemental Material

Supplemental material is available online with this article.

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