Fovea-Sparing Retinal Detachments: Time to Surgery and Visual Outcomes

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• PURPOSE: To study the effect of the duration from initial evaluation to repair on outcomes for fovea-sparing rhegmatogenous retinal detachment (RRD).

• DESIGN: Retrospective, single-surgeon, consecutive case series.

• METHODS: Medical records were reviewed for preoperative and intraoperative factors possibly associated with visual and anatomic outcomes for all patients undergoing scleral buckling procedure (SBP) for fovea-sparing, primary RRD between 1989 and 2004.

• RESULTS: Fifty-five percent of 199 patients had symptoms for ≤ 7 days, 83% had best-corrected visual acuity (BCVA) ≥ 20/40, and 33% had a RRD that had extended to within the macular arcade vessels. Eighty-five percent were operated within 3 days, including 56% within 24 hours. One case progressed to fovea-off status before surgery 4 days after initial evaluation (0.5%). The single-operation success rate was 88% and final anatomic success was 99.5% (1 patient refused reoperation). Eighty-six percent were examined postoperatively for at least 2 months; 73% had ≥ 20/40 vision. The strongest predictor of postoperative BCVA was initial BCVA ($r = 0.47$; $P < .001$). There was no statistically significant difference in postoperative BCVA or single-operation success rate at any point within 3 days of initial examination. No statistically significant correlation was found between postoperative BCVA and duration of symptoms, RRD location, direction of the closest approach of the RRD to the fovea, or need for reoperation.

• CONCLUSIONS: Progression to fovea-off status was rare in this series when a selectively urgent, but not strictly emergent, surgical approach was employed for fovea-sparing RRD. (Am J Ophthalmol 2010;xx:xxx. © 2010 Published by Elsevier Inc.)

RHEGMATOGENOUS RETINAL DETACHMENT (RRD) IS a serious ocular disorder that may result in severe visual loss.[1] Many treatment options have been established, but the scleral buckling procedure (SBP) has been a standard treatment for RRD for over 50 years.[2–4] While many preoperative and intraoperative prognostic factors have been studied, the strongest and most consistent predictors of visual outcome have been preoperative visual acuity and foveal detachment.[5–17] The rationale for prompt surgery in eyes with a fovea-sparing RRD is to prevent foveal detachment. Many consider a fovea-sparing RRD of recent onset to be a surgical emergency, but few studies have evaluated this presumption.[18,19]

The current study investigates a series of primary, fovea-sparing RRD managed with SBP and assesses visual and anatomic outcomes, as well as progression and complications. The effect of the duration of time from initial patient evaluation to surgical repair was the primary focus of the study.

PATIENTS AND METHODS

THE STUDY DESIGN WAS A RETROSPECTIVE, NONRANDOMized, consecutive case series. The medical records of all patients who underwent primary SBP (without vitrectomy) for primary fovea-sparing RRD performed by a single surgeon (W.E.S.) at Bascom Palmer Eye Institute between July 1989 and April 2004 were reviewed. The surgeon's treatment algorithm was to attempt scleral buckling alone in primary cases, reserving vitrectomy techniques for exceptional cases with more advanced media opacities, epiretinal membranes, or large retinal breaks. The general clinical bias was to operate more quickly for RRD that had extended more posteriorly, for RRD that were superior or temporal in location, and for patients with a shorter duration of symptoms.

Preoperative data collected included patient age, gender, lens status, time and date of first documentation of RRD, duration and quality of symptoms, refractive error, previous eye surgery, other eye diseases, location and extent of RRD, direction of the closest approach of the RRD to the fovea, and best-corrected visual acuity (BCVA). The time of initial documentation of RRD (time of initial patient evaluation) was most commonly determined as the time that the intraocular pressure measurement was recorded at the initial clinical evaluation. Since all patients in this study had fovea-sparing RRD, the preoperative BCVA was usually excellent; if it was < 20/40, the reason was recorded. Patients with giant retinal tears, failed prior pneumatic retinopexy, retinal dialyses, or severe, acute trauma with other concurrent ocular injury were excluded. Intraoperative data collected included date and time of surgical repair, location and number of retinal breaks,

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drainage of subretinal fluid, gas injection, scleral buckle configuration, and complications. The extent of any progression in the distribution of the RRD was not systematically measured except to verify whether the macula had become detached since the preoperative examination had been performed.

Postoperative data collected included reoperations; 2-month, 6-month, and 12-month BCVA; retinal attachment status at postoperative visits; and additional surgical management. Patients referred for treatment of acute-onset, primary RRD were commonly returned to their comprehensive ophthalmologist or home locality as soon as possible. Hence, there was a follow-up period < 2 months for 27 eyes (14%); for many others the final follow-up examination took place at about 2 months postoperatively and clinical experience is that the risk of recurrent RRD after 2 months is low.[15,20]

All eyes underwent SBP using standard surgical techniques. Cryotherapy was used in all patients to treat retinal breaks. Encircling silicone bands, circumferentially oriented silicone tires, or radially oriented sponges were used in different combinations; generally, all pseudophakic or aphakic eyes were encircled, solitary tears occurring posterior to the equator were commonly supported on radial sponges, and broader circumferential elements were used if multiple tears at or posterior to the equator were present or if other tractional pathology was detected. Drainage of subretinal fluid was commonly performed in the following situations: when a large-volume exoplant was used; when highly bullous detachments jeopardized accurate localization of break(s); or when there were multiple retinal breaks, inferior breaks, chronic retinal detachments, or uncertain break location. Normal intraocular pressure after drainage was usually restored with air; sulfur hexafluoride or perfluoropropane were more commonly used if the breaks were posterior or were highly elevated over the buckled retinal pigment epithelium, especially in nondrainage cases. No special decision making or techniques were invoked because of proximity of the detached retina to the fovea or the timing of the procedure.

Descriptive statistics are presented for demographic and ocular characteristics. Categorical variables were analyzed using the χ^2 test or the Fisher exact test and continuous variables were analyzed using the Student *t* test. Kaplan-Meier survival analysis was performed to compute the rate of reoperation. Analysis of variance (ANOVA) methods were used to study the differences in visual acuity outcomes between groups of patients based on the duration from initial evaluation to surgical repair. Visual acuity was treated as a continuous variable after applying a logarithm of the minimal angle of resolution (logMAR) transformation for the ANOVA. All statistical analyses were performed using SPSS version 17 (SPSS, Chicago, Illinois, USA).

TABLE 1. Demographic and Baseline Characteristics of Patients With Fovea-Sparing Rhegmatogenous Retinal Detachments (n = 199)

Operated eye, right	114 (57%)
Age, mean years	54 (SD 15, range 16–87)
Gender, male	111 (56%)
Follow-up, median months	17 (range 0–190)
Previous ocular surgery or laser	109 (55%)
Lens status, n (%)	
Phakic	122 (61)
Pseudophakic	73 (37)
Aphakic	4 (2)
Refractive error, n (%)	
Myopia < −6D	88 (44)
Myopia > −6D	42 (21)
Hyperopic, plano, or unknown	69 (35)
RRD extent, n (%)	
1 quadrant	108 (55)
2 quadrants	72 (36)
3 or 4 quadrants	18 (9)
RRD posterior extension, n (%)	
Only anterior to the equator	11 (6)
Posterior to the equator but not within the macular arcades	123 (62)
Within the macular arcades	65 (33)
Direction of closest approach of the RRD to the fovea, n (%)	
Inferior	59 (30)
Superior	56 (29)
Temporal	50 (25)
Nasal	31 (16)

D = diopters; RRD = rhegmatogenous retinal detachment; SD = standard deviation.

RESULTS

• **PREOPERATIVE DATA:** Primary, fovea-sparing RRDs were diagnosed and treated by scleral buckling without vitrectomy in 199 patients (Table 1). The mean age was 54 years and 111 patients (56%) were male. There were 109 eyes (55%) that had undergone prior surgical or laser interventions, including cataract surgery in 77 eyes (39%), yttrium-aluminum-garnet (YAG) capsulotomy in 12 eyes (16% of pseudophakic eyes), refractive surgery in 6 eyes (3%), glaucoma surgery in 4 eyes (2%), retinal tears treated with cryopexy or laser in 34 eyes (17%), and other procedures in 14 eyes (7%). Symptoms reported included floaters in 142 eyes (71%), visual field defect in 107 eyes (54%), photopsias in 76 eyes (38%), and loss of vision in 50 eyes (25%). Duration from onset of symptoms to initial evaluation was less than 1 week for 109 eyes (55%) and more than 1 month for 22 eyes (11%).

Preoperative BCVA was ≥ 20/25 in 108 eyes (54%), ≥ 20/40 in 166 eyes (83%), and ≤ 20/50 in 33 eyes (17%)

TABLE 2. Visual Acuity of Patients With Fovea-Sparing Rhegmatogenous Retinal Detachments

	Preoperative n = 199	Postoperative n = 172	Postoperative Vision According to Time From Initial Evaluation to Surgery[a]			
	All Patients	All Patients	< 12 h (n = 46)	12–24 h (n = 47)	1–3 d (n = 53)	> 3 d (n = 26)
Median	20/25	20/30	20/25	20/30	20/30	20/30
≥ 20/25	108 (54%)	77 (45%)	24 (52%)	20 (43%)	22 (42%)	11 (42%)
20/30-20/40	58 (29%)	48 (28%)	12 (26%)	17 (36%)	15 (28%)	4 (15%)
≤ 20/50	33 (17%)	47 (27%)	10 (22%)	10 (21%)	16 (30%)	11 (42%)

Postoperative visual acuities are from postoperative visits at 2 months.

[a]There was no statistical difference among postoperative visual acuity outcomes by time from initial evaluation to surgery. $P = .20$ (by median visual acuity, Kruskal-Wallis test); $P = .33$ (by visual acuity groupings, χ^2 test).

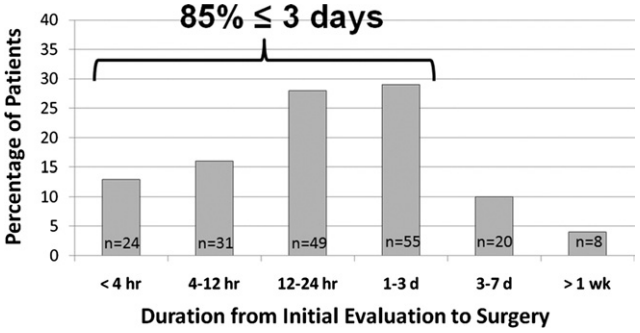

FIGURE 1. Bar graph showing the time duration from initial evaluation to surgery for patients presenting with fovea-sparing rhegmatogenous retinal detachments. hr = hours; d = days; wk = weeks.

(Table 2). Median preoperative visual acuity was 20/25 (range 20/15 to hand motions). The clinical explanation for vision < 20/40 at initial evaluation included 1 or more of the following: macular disease in 9 eyes (27%), cataract in 8 eyes (24%), vitreous hemorrhage in 8 eyes (24%), amblyopia in 5 eyes (15%), and corneal opacity in 3 eyes (9%). The reason for initially reduced vision was not identified in 8 eyes (24%). The RRD involved 1 quadrant in 108 eyes (55%), 2 quadrants in 72 eyes (36%), 3 quadrants in 17 eyes (8.5%), and 4 quadrants in 1 eye (0.5%). The posterior extent of the RRD extended within the macular arcade vessels in 65 eyes (33%), were posterior to the equator but not within the macular arcade vessels in 123 eyes (62%), and remained anterior to the equator in 11 eyes (6%). The direction of the closest RRD approach to the fovea was inferior in 59 eyes (30%), superior in 56 eyes (29%), temporal in 50 eyes (25%), and nasal in 31 eyes (16%).

Surgery was performed on a weekend or holiday for 12 patients (6%) and during the week for the remaining 187 patients (94%). Time from initial evaluation to the operating room was recorded and available for 187 eyes (94%); it was less than 24 hours in 104 eyes (56%) and less than 72 hours in 159 eyes (85%) (Figure 1). Three clinical variables were statistically correlated with a shorter interval from initial patient evaluation to surgery (Table 3): a shorter duration of symptoms ($P < .001$); patients with a RRD whose closest approach to the fovea was superior or temporal were operated sooner (median 21.0 hours; n = 106), compared to patients with a RRD whose closest point to the fovea was inferior or nasal (median 29 hours; n = 90) ($P = .02$); patients with superior retinal breaks

TABLE 3. Preoperative Variables Associated With a Shorter Interval From Initial Evaluation to Surgery for Patients With Fovea-Sparing Rhegmatogenous Retinal Detachments

Variable	Time to Surgery[a]
Symptom duration	$P < .001$
Direction closest to fovea[b]	
Superior or temporal	21 (n = 106)
Inferior or nasal	29 (n = 90)
Location of retinal breaks[c]	
Superior (9 to 3 o'clock)	23 (n = 130)
Inferior or none identified	40 (n = 69)

[a]Times from initial evaluation to surgery are median hours.
[b]$P = .02$; statistical analyses using Kruskal-Wallis test.
[c]$P = .009$; statistical analyses using Kruskal-Wallis test.

TABLE 4. Interval From Initial Evaluation to Surgery and Final Visual Outcomes by Day of the Week for Patients With Fovea-Sparing Rhegmatogenous Retinal Detachments

Initial Evaluation	Number (%) of Patients	Time to Surgery, Median Hours[a]	Final VA (n)[b]
Friday or Saturday	49 (25%)	68	20/30 (45)
Sunday-Thursday	150 (75%)	22	20/30 (127)

VA = visual acuity; final median visual acuity recorded at 2 months postoperatively.
[a]$P < .001$; statistical analyses using Kruskal-Wallis test.
[b]$P = .20$; statistical analyses using Kruskal-Wallis test.

(9-o'clock to 3-o'clock position) were operated sooner (median 23.0 hours; n = 130), compared to patients with inferior retinal breaks or no identified retinal breaks (median 40 hours; n = 69) (P = .009). There was no statistically significant correlation of the duration from initial evaluation to surgery and the number of quadrants involved (P = .49) or posterior extent of the RRD (P = .22).

Patients initially evaluated on Friday or Saturday (n = 49, 25%) had a longer time to surgery (median 68 hours) than for other days (median 22 hours; $P < .001$) (Table 4). Furthermore, patients initially evaluated on Friday (n = 38, 19%) had the longest median time to surgery, 71.4 hours (mean 70 hours, SD 58 hours). Of the Friday patients, however, there was a bimodal distribution, with certain patients operated within 24 hours (n = 10, 26%) and others operated 3 days later (n = 22, 58%). A small fraction were operated beyond 3 days (n = 6, 16%). In particular, Friday patients with a superior or temporal RRD (n = 15) were operated sooner if their duration of symptoms was ≤ 3 days (median 6 hours, range 2 to 68 hours; n = 4) versus 4 to 7 days (median 69 hours, range 4 to 125 hours; n = 6) or > 30 days (median 110 hours, range 75 to 148 hours; n = 4; P = .03). In contrast, time to surgery for patients with superior or temporal RRD initially evaluated on other days was not related to duration of symptoms.

Time from initial evaluation to surgery was longer than 7 days for 8 patients, including those with RRDs diagnosed bilaterally (5 patients) and those whose surgeries were delayed for medical problems, personal reasons, or a hurricane constraint (1 patient each). The 1 RRD that progressed to involve the fovea while waiting for surgical repair was aphakic, and was initially evaluated at what turned out to be 2.5 days before Hurricane Andrew, with a superior detachment and 20/50 vision. The patient returned the day after the storm, 4 days after initial evaluation, having progressed to foveal involvement and 3/200 vision. Surgery was performed the following day with recovery of 20/40 vision.

• **INTRAOPERATIVE DATA:** A definite retinal break was identified in 188 eyes (95%), including 94 eyes (47%) in which multiple breaks were found and no definite retinal break was found in 11 eyes (6%). Retinal breaks were identified superiorly in 130 eyes (65%) and inferiorly in 77 eyes (39%). Of the 161 eyes with retinal break(s) isolated to 1 quadrant, these were located between the 12- and 3-o'clock position in 44 (27%), between the 3- and 6-o'clock position in 26 (16%), between the 6- and 9-o'clock position in 29 (18%), and between the 9- and 12-o'clock position in 62 (39%). An encircling scleral buckling element was placed in 158 eyes (79%) and the remaining 41 eyes (21%) had only a segmental element. Air was injected in 28 eyes (14%) and gas was injected in 37 eyes (19%) (32 received perfluoropropane and 5 received sulfur hexafluoride). Subretinal fluid was drained in 87 eyes (44%). Intraoperative complications included localized subretinal hemorrhage during drainage of subretinal fluid in 18 eyes (9%) and vitreous hemorrhage in 1 eye (0.5%); all resolved without visual consequences.

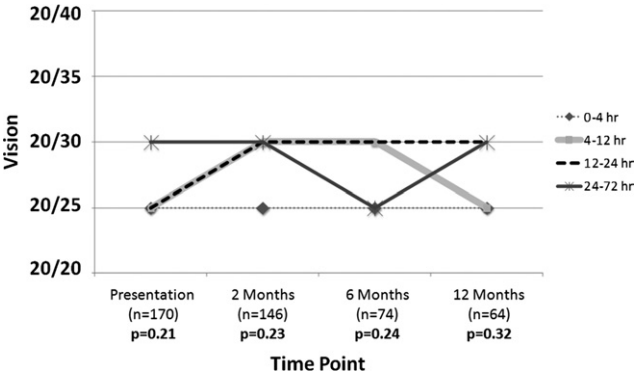

FIGURE 2. Line graph of median visual acuities at presentation and 2, 6, and 12 months postoperatively according to the interval from initial patient evaluation to surgery for patients with fovea-sparing rhegmatogenous retinal detachments. Statistical analyses using Kruskal-Wallis test. hr = hours.

• **ANATOMIC RESULTS:** The retina was reattached in a single operation in 175 eyes (88%). Persistent subretinal fluid requiring reoperation was present in 24 eyes (12%). A single reoperation was successful in 16 eyes (8%), 2 reoperations were required in 6 eyes (3%), 4 reoperations were required in 1 eye (0.5%), and 1 patient refused any reoperation (0.5%). Initial reoperations were managed with scleral buckle revision alone in 6 eyes (26%), pars plana vitrectomy alone in 16 eyes (70%), and both scleral buckle revision and vitrectomy in 1 eye (4%). Final anatomic success was achieved in 198 eyes (99.5%). The single-operation anatomic success rate was not significantly correlated with the preoperative or intraoperative factors analyzed including length of time from initial evaluation to surgery, the day of the week on which the patient was first evaluated, age, gender, lens status, duration of symptoms, refractive error, location or extent of the RRD, direction of the closest approach of the RRD to the fovea, location or number of retinal breaks, use of intraocular gas, scleral buckle type, drainage of subretinal fluid, and intraoperative complications.

• **VISUAL RESULTS:** BCVA was recorded for 172 patients (86%) with 2 months of postoperative follow-up information. The median BCVA at 2 months postoperatively was 20/30 (range 20/15 to counting fingers), with BCVA ≥ 20/40 in 125 eyes (73%) and BCVA ≤ 20/50 in 47 eyes (27%) (Table 2). There were no statistically significant differences in median or mean postoperative BCVA at the 6-month (P = .85) or 1-year (P = .69) postoperative visits compared to the 2-month time point.

The strongest predictor of BCVA at the 2-, 6-, and 12-month postoperative visits was presenting BCVA (r =

0.47, 0.48, and 0.57 respectively; $P < .001$). The effect of duration of time from initial evaluation to surgical repair was analyzed by a 1-way ANOVA to compare the median BCVA at each of the following time ranges: 0 to 4 hours, 4 to 12 hours, 12 to 24 hours, and 24 to 72 hours (Figure 2). No significant differences in visual outcomes were identified between any of the subgroups for preoperative ($P = .21$), 2-month ($P = .23$), 6-month ($P = .24$), or 12-month ($P = .32$) visual acuities. Additionally, there were no significant differences in visual acuity outcomes related to the duration from initial evaluation to surgical repair when patients operated more than 3 days after presentation were included (n = 28, 14%).

The only other prognostic factor that correlated with visual outcomes was the extent of the RRD ($P = .05$); specifically, patients with a RRD involving only 1 quadrant were more likely to have better vision than those with more quadrants involved. There were no statistically significant correlations between visual outcomes and age, gender, lens status, duration of symptoms, refractive error, location of the RRD, direction of the closest approach of the RRD to the fovea, location or number of retinal breaks, use of intraocular gas, drainage of subretinal fluid, intraoperative complications, or need for reoperation.

Despite a longer time from initial evaluation to surgery for Friday and Saturday patients, there was no statistically significant difference in visual outcomes among the groups ($P = .20$) (Table 4). When each day of the week was examined independently, all had equivalent visual outcomes ($P = .82$).

DISCUSSION

FOVEAL INVOLVEMENT IS THE STRONGEST ESTABLISHED risk factor for poorer anatomic and visual success in an incident RRD.[16,17,21] Thus, therapeutic efforts are generally pursued more urgently in fovea-threatening cases to preempt foveal involvement. Features that connote a more rapid progression have been suspected but not well established, yet may play a pivotal role in determining how urgently treatment should be pursued. The current study embodied a common management algorithm in which 44% of eyes were operated more than 24 hours after initial evaluation; progression to foveal involvement occurred in only 1 of 199 eyes. The principal finding of this study was that, within the inherent bias of the clinical algorithm, the duration from diagnosis to treatment did not affect anatomic or visual outcomes.

The variable length of follow-up, including less than 2 months for 27 patients (14%), limits the power of this study's conclusions but represents a "real-world" experience, since a large fraction of patients with RRD return for long-term follow-up care with their comprehensive ophthalmologists for convenience. Data for these patients were excluded from the visual outcome analysis as an attempt to minimize this impact. Similarly, the authors clearly recognize that the treatment algorithm, which is widely used by retina specialists, introduced bias, but the results of the current study largely validated its application.

The mechanism of RRD extension seems to involve factors such as the size and location of the retinal break(s), residual traction, and degree of vitreous liquefaction.[22,23] Subretinal fluid characteristically spreads first anteriorly to the ora serrata, then posteriorly in accordance with gravitational dependence and motion-induced ocular fluid currents.[22] Additionally, vitreous has a higher specific gravity than aqueous and gravity-enhanced vitreous traction may open a superior tear more, whereas the vitreous may provide some tamponade effect on inferior breaks.[24,25] Consequently, a superior RRD has been commonly considered to progress more rapidly[25] and merit more prompt repair. A recent series of 82 RRDs not involving the fovea reported that 11 (13%) had documented progression of subretinal fluid, including 3 to involve the fovea;[19] those authors found no statistically significant risk factors for progression, but it is notable that 8 (75%) of these were superior RRDs, suggesting that such cases might be accorded a higher degree of concern for emergent treatment.

Conversely, though, the current study demonstrates that at least in cases with delineated characteristics, the rate of progression is probably slower than might be intuitively feared and definitive treatment may be safely pursued less emergently, a day or 2 later. In this series, 3 factors were associated with a shorter time from initial evaluation to surgery: a shorter duration of symptoms ($P < .001$), a superior or temporal RRD distribution ($P = .02$), and the presence of superior retinal breaks ($P = .009$), reflecting that supposition. While patients presenting on a Friday or Saturday had a longer time to surgery than patients who presented on Sunday through Thursday, there was no difference in visual or anatomic outcomes. However, the patients who presented on Friday with a superior or temporal RRD and a shorter duration of symptoms were operated sooner than those with a longer duration of symptoms ($P = .03$), even when compared to other days of the week. The management algorithm employed in the current study prohibited testing the effects of a delay for superior and temporally located RRDs and for patients with short symptom duration. Eyes with factors auguring rapid progression were usually operated within a few hours, but those with signs of some stability were safely deferred until Monday. Most significantly, progression to involve the fovea occurred in only 1 of the 199 patients, and an unintended delay constrained by a natural disaster factored into that case.

The flexibility of even a short deferral period before surgery offers numerous potential benefits to patients, health care providers, and the health care system. The patient will often appreciate the time to attend to personal matters like assembling a support team. The physician has opportunity to approach the surgery without disrupting scheduled clinics and with a familiar staff. The health

system may be afforded a better opportunity to deliver the care in a more cost-effective and less disruptive manner.[18] It would seem reasonable that these findings could be extrapolated beyond RRD eyes undergoing scleral buckling to include all RRD treatment modalities. With the trend of primary vitrectomy for repair of RRD, these considerations might be even more prescient. Thus, clinical judgment coupled with a strategy for selectively urgent surgical repair may optimize treatment outcomes. While waiting for surgery, it is probably optimal to minimize patient activity—some advocate bed rest and immobilization of the involved eye or both eyes to retard progression.[26–28]

This study demonstrates that with a consideration of several ascertainable features, many fovea-sparing RRDs may be safely deferred for a short period of time. The selectively urgent, rather than exclusively emergent, approach may optimize delivery of care for this important disease entity.

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Biosketch

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Biosketch

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