Scleral buckle: does it still have a role in retinal detachment repair?

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ABSTRACT

The current armamentarium for the repair of rhegmatogenous retinal detachment consists of a variety of surgical approaches including pneumatic retinopexy, scleral buckle, pars plana vitrectomy alone or in combination with an encircling buckle. Inevitably having options invites comparisons generates dilemmas and creates controversies as to which of these procedures is optimal in reattaching the retina. Numerous prospective and retrospective studies have attempted to compare their efficacy, yet the results are still conflicting. Moreover scleral buckling cases are steadily declining with PPV becoming the modality of choice for the majority of surgeons. Here we explore the current controversy whether scleral buckle still has a role in RRD repair in the modern era of vitreoretinal surgery.

Keywords: rhegmatogenous retinal detachment, scleral buckle, pars plana vitrectomy.

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Introduction

RRD is an important cause of visual morbidity with an estimated annual incidence of 1 per 10.000 where surgical intervention is imperative to prevent permanent visual loss.[1] The key principles of every retinal detachment surgery are the identification and subsequent treatment of all retinal breaks and the relief of vitreous traction. Current techniques for RRD repair include sclera buckling (SB), pneumatic retinopexy and pars plana vitrectomy with or without combination of SB.

Since the introduction of SB by Ernst Custodis and its popularisation in the United States by Schepens in the 1950s SB has been for many decades the gold standard technique for RRD repair.[2,3] The second milestone in vitreoretinal surgery was the invention of PPV in the early 1970s by Robert Machemer, and ever since PPV has increasingly becoming more and more popular amongst vitreoretinal surgeons as the technique of choice for primary RRD repair.[4]

Scleral buckling works by decreasing indirectly the radial vitreous traction exerted on the retina and displacing the sub retinal fluid away from location of the retinal break. In addition, it provides, support to the vitreous base and brings the retinal pigment epithelium (RPE) closer to the retina, thus facilitating drainage of the SRF. Clear advantages of SB procedure include lower incidence of postop-

Author	Study Type	N	F/U	SOSR	FASR (%)	Visual Outcome	Comments	Reference
Tani (1980)	Retrospective	173	6 months	99%	N/A	>20/50 (76%)	Only macula-on RRDs. 76% of patients had better than 20/50 final VA	32
Kreissig (1992)	Prospective	107	11 years	92.60%	97%	20/40	Study included 71% radial buckles, 19% circumferential, and 10% radial combined with circumferential buckles	33
Ross (1998)	Prospective	100	10.8 months	96%	N/A	20/60	Included only macula-off detachments	34
Schwartz (2002)	Retrospective	227	20 years	82%	95%	20/40		12
Haritoglou (2010)	Retrospective	524	>6 months	89.7% (Ph) 73.9% (Ps)	96.4%	N/A	No functional data provided	35
Thelen (2010)	Retrospective	4325	N/A	84.45% (Ph) 82.88% (Ps) 81.88% (A)	N/A	N/A	No functional data provided	13
Figueroa (2002)	Randomized	60	27 months	87-90%	N/A	67% gain 3.5 lines	Study comparing need of cryotherapy in SB	36

SOSR: single operation success rate, FASR: final anatomic success rate, VA: visual acuity

Table 1. Scleral buckling for uncomplicated rhegmatogenous retinal detachment

erative cataract formation, lower endophthalmitis rates and no requirement for postoperative positioning or air-travel restriction (when intraocular gas tamponade is not utilised). On the other hand SB can be particularly challenging in a subset of patients including high myopes with posterior breaks, thin sclera, glaucoma drainage devices and patients with giant retinal tears (GRTs). Complications associated with SB have been traditionally divided into intraoperative and postoperative and include subretinal or suprachoroidal haemorrhage, retinal incarceration when drainage is per-

Author	Study Type	N	F/U	SOSR (%)	FASR (%)	Visual Outcome	Comments	Reference
Campo (1999)	Prospective	275	19 months	86-91%	96%	20/40	Pseudophakic	21
Speicher (2000)	Retrospective	78	4 months	93.60%	96.20%	20/25	Mac on & off RRDs	19
Sharma (2004)	Randomized	48	6 months	81.30%	95.80%	20/66	Study included inferior breaks	37
Mendrinos (2008)	Prospective	100	12 months	92%	97%	20/40	Pseudophakic 20G	18
Martinez-Castillo (2005)	Prospective	40	7 months	90%	100%	20/30	Mac on & off RRDs Pseudophakic	20
Lai (2008)	Retrospective	53	8 months	74%	100%	20/60	Mac on & off RRDs Only 25G	38
Johansson (2006)	Retrospective	37	>3 months	89.1%	N/A	20/55		39

SOSR: single operation success rate, FASR: final anatomic success rate

Table 2. Pars plana vitrectomy for uncomplicated rhegmatogenous retinal detachment

Author	Study Type	N		F/U	SOSR (%)		Visual Outcome		Comments	Reference
		SB	PPV		SB	PPV	SB	PPV		
Miki (2001)	Retrospective	138	87	>6 months	92%	92%	N/A	N/A		40
Ahmadieh (2005)	Randomized	126	99	6 months	68%	63%	20/182	20/182	Pseudophakic/Aphakic RDs	24
Brazitikos (2005)	Randomized	75	75	1 year	83%	94%	20/50	20/43	Pseudophakic	10
Sharma (2005)	Randomized	25	25	6 months	76%	84%	20/105	20/71		37
Heimann (2007)	Randomized	195	174	5 years	63.6%	63.8%	20/43	20/60	Phakic group	16
Heimann (2007)	Randomized	133	132	5 years	53.4%	72%	20/57	20/47	Pseudophakic/Aphakic group	16

SOSR: single operation success rate, FASR: final anatomic success rate

Table 3. Studies comparing pars plana vitrectomy vs scleral buckling for uncomplicated rhegmatogenous retinal detachment

formed, promotion of PVR with excessive cryotherapy, strabismus, significant postoperative pain, short- or long-term buckle infection or extrusion, among others. In addition, patients undergoing SB experience a prolonged recovery period. However, the main disadvantage of SB surgery is the induction of axial myopia and/or astigmatism. Prior studies have shown that patients with encircling scleral buckles can experience an average induced myopia of 2.75 diopters, which is particularly concerning in the current patient population where the number of patients who undergo refractive surgery procedures is increasing.[5]

PPV has a clear advantage over SB in cases with media opacities (e.g. vitreous haemorrhage) and proliferative vitreoretinopathy (PVR) as it allows direct relief of vitreous traction and intraoperative visualisation of retinal breaks, internal drainage of SRF and retinal reattachment. It requires some form of intraocular tamponade either with gas or silicone oil and positioning after surgery. Current microincisional transconjunctival systems using 23- 25- and 27-gauge systems have significantly reduced postoperative inflammation and improved patient comfort and recovery after surgery. The advent of perfuorocarbon liquids and wide field viewing systems have significantly altered the prognosis and management of complex retinal detachment cases with posterior breaks, GRTs and/or advanced PVR. A well-established complication associated with PPV is the acceleration of cataract formation, as well as the generation of iatrogenic retinal breaks and increased risk for intraocular infection.

This article attempts to explore the current controversy and review the current evidence in the literature of vitreoretinal surgery as to whether scleral buckling has still a role in modern RRD repair.

The controversy

Although initial studies have indicated a similar anatomic rate between SB and PPV, over the last decade there has been a clear trend favouring PPV over SB for primary RRD repair amongst vitreoretinal surgeons.[6] According to Medicare data the number of stand-alone scleral buckling procedures has declined in the decade 1997-2007 by 69% whereas PPV number cases increased 72% over the same period.[7] Inevitably, the exposure to SB in current training programs is directly affected due to this trend. According to data from the Association of University Professors in Ophthalmology from 2009-2013, the average number of primary SB procedures (SBP) performed by retina fellows during the two-year fellowship ranged from 48-65 compared to almost six times more PPV cases.[8] Interestingly, the number may be as low as 30, which is considered a minimum to achieve stable clinical results for SBP.[9] This imbalance in exposure and practice of SBP versus PPV puts

into question whether current graduating fellows reach adequate level of training and expertise relative to PPV in the management of RRD with SB.

Furthermore, the level of surgeon's experience and proficiency for a surgical technique is directly related with operative times. It is widely accepted that SB is more laborious and time consuming than PPV even among experienced surgeons.[10] Thus, in the current era of decreasing reimbursements and maximising efficiency and volume increased operative times for procedures with similar clinical outcomes will inevitably affect surgical decision-making.

Finally, the role of the industry shall not be neglected in this phenomenon as vitrectomy instrumentation has experienced continuous refinement and increasing marketing exposure over the last decade compared to the relatively unchanged SB techniques. Intimately associated with research and development costs, vitrectomy consumables and procedures in general are inherently more expensive than scleral buckling materials. A recent cost comparison of RRD repair between phakic, pseudophakic and aphakic patients, showed that SB was 10.7% less expensive than PPV for RRD repair in phakic patients, which was attributed to the cataractogenesis and subsequent need for cataract extraction after PPV.[11]

The data

Several single centre prospective and retrospective studies have demonstrated so far that SB surgery achieves functional and anatomical results comparable to PPV for uncomplicated RRD repair. The main outcome measures of these studies were single operation success rate (SOSR), final anatomic success rate after reoperations and visual acuity data. The results of these studies are summarised in Tables 1, 2 and 3. Single operation success rates for SB ranged from 82-99%, whereas for PPV was 75%-96.2%. A study looking at 20 year follow-up data of patients, who underwent SBP repair for RRD, demonstrated 82% SOSR, 95% final anatomic success rate with median final visual acuity of 20/40 after a single procedure and 20/50 after multiple operations.[12] Another large case series of 4.325 RRDs treated with SB demonstrated that the lens status does not play a role in the final anatomical outcome.[13] The detachment of the macula seems to alter significantly the visual prognosis with only 40-60% of patients with macula-off detachments achieving a final visual acuity of 20/50 or better despite successful reattachment.[14,15] In two recent prospective randomised multicenter trials from Europe, phakic patients with RRD had better visual outcomes with SB than with PPV.[16,17] In the Scleral buckling versus primary vitrectomy study (SPR study), which recruited 416 phakic and 265 pseudophakic RRDs, phakic patients had no significant differences in the single operation anatomical success rates (63.6% for SB vs 63.8 for PPV) or final anatomical success (96.7% for SB vs 96.6 for PPV). The markedly lower SOSR of the SPR study compared to the prior studies is likely due to the more strict redetachment criteria defined by the study criteria (a small peripheral area of SRF counted as redetachment). However the study showed a significantly greater cataract rate after PPV compared with the SB rate, which explains the better visual outcome in the SB group.

In pseudophakic RRDs, the literature indicates that PPV may be more beneficial from SB. Several studies have advocated PPV for primary uncomplicated pseudophakic RRDs.[18-20] In the largest prospective study of primary RRDs repaired by PPV only, the SOSR was 87.6% and final anatomical success 96.4% with a final median visual acuity of 20/40 (median initial visual acuity was 20/300)[21]. In the pseudophakic/aphakic arm of the SPR study, the anatomical results of PPV seemed to be superior to those of SB, but without any significant difference in the visual outcome.[16] These results were further confirmed by two recent meta-analyses that analysed the available randomised control trials on the topic.[22,23] These results can be partially explained by the challenging peripheral retinal examination of the pseudophakic patient due to anterior and/or posterior capsule opacification, cortical remnants and intraocular lens optical aberrations, where small anterior breaks cannot be easily identified. In fact, studies have reported a 25-30% missing rate for retinal breaks in pseudophakic RRDs.[18,24] Compared to SB, PPV offers intraoperative removal of posterior capsular opacities for better visualisation of the peripheral retina and with the use of wide-angle viewing systems in conjunction with scleral depression detailed inspection of the retinal periphery is more feasible.

To this aim, many authors have advocated the addition of an encircling element especially in pseudophakic patients. Several prospective and retrospective studies have been conducted to compare the potential benefit of adjuvant use of an encircling SB to PPV especially in pseudophakic RRDs but the results are controversial.[25-27] The adjuvant use of SB to PPV has been advocated in certain patients with extensive inferior pathology or PVR[28]. In a meta-analysis of studies published from 1966 through 2004, which included 457 eyes undergoing PPV and 194 PPV with SB, no significant differences were found between PPV alone and the combined technique for initial and final anatomic outcomes.[29] Moreover, in the EVERS Retinal Detachment Study, a multicenter retrospective study based on self-reported data from 7.678 cases, PPV with adjuvant SB

(N=488) had increased anatomic failure rate compared to PPV alone (N=2.235).[30] More recently, Orlin et al. showed no difference in single surgery anatomical success, final anatomical success, or change in visual acuity when comparing PPV with PPV/SB in the repair of primary noncomplex rhegmatogenous retinal detachment in an academic setting.[31] However, the nature and methodology of the published studies (retrospective survey-based for the EVRS) does not provide us with a high level of evidence regarding the effect of SB as an adjunct to vitrectomy.

Conclusion

Similar to the dilemmas that the advent of phacoemulsification generated among anterior segment surgeons, retina specialists today face a controversy between the established and effective techniques of scleral buckling versus the constantly evolving new technology and techniques of pars plana vitrectomy. A constellation of factors may be contributing to this overall shift in preference from SB to PPV over the past few decades, including little to no industry involvement, economic issues and imbalanced training of young retina specialists. The current literature indicates that scleral buckling procedures are advantageous in the treatment of RRD repairs, especially in young phakic patients or patients with traumatic RRDs associated with retinal dialysis. In pseudophakic patients, PPV seems to have a benefit over SB. In addition, there is no evidence to support the routine adjunct of SB to PPV cases. Given the clinical heterogeneity of RRD appropriate case selection, clinical judgment and in depth knowledge of the indications, advantages and disadvantages of both techniques are invaluable tools in the management of patients with RRD.[32-40]

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