Throwing New Light on Buckling Surgery

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Scleral buckling was first performed as a technique to repair rhegmatogenous retinal detachment by Custodis in 1949 and was popularized in the 1950s.[1,2] The underlying principle in scleral buckling is approximation of neurosensory retina with the retinal pigment epithelium by compression of the globe wall, thus preventing passage of liquid vitreous into the subretinal space. If the break is properly closed, the retinal pigment epithelium pump actively absorbs subretinal fluid and the retina will spontaneously reattach with no need for subretinal fluid drainage.

Until the introduction of pars plana vitrectomy (PPV) in the early 1970s by Machemer et al,[3] scleral buckling was the gold standard technique for management of rhegmatogenous retinal detachment. Soon after its introduction, PPV enhanced the ability to repair retinal detachments, particularly in settings of complex cases,[4,5] trauma,[6,7] and proliferative vitreoretinopathy (PVR).[8-10] The use of PPV has expanded in the repair of retinal detachments, particularly in patients with pseudophakic eyes.[11,12]

Apart from vitrectomy and scleral buckling, another procedure, pneumoretinopexy, has also been used in specific configurations of retinal detachments with breaks located superiorly. It requires good case selection, however, and also needs significant cooperation of the patient for postprocedure positioning. In phakic eyes, it was associated with a significantly higher reoperation rate than scleral buckling, but resulted in equivalent final visual outcome and reattachment rate after reoperations.[13]

The type of surgical procedure used for rhegmatogenous retinal detachment, however, still remains an individual surgeon-based decision that is influenced by the preoperative findings, patient characteristics, available tools for surgery, and, above all, the experience and ability of the operating surgeon. What this essentially means is that, for a fresh retinal detachment with a single superior tear, different surgeons would choose any 1 of the 3 procedures mentioned based on their specific training or experience using a certain technique.

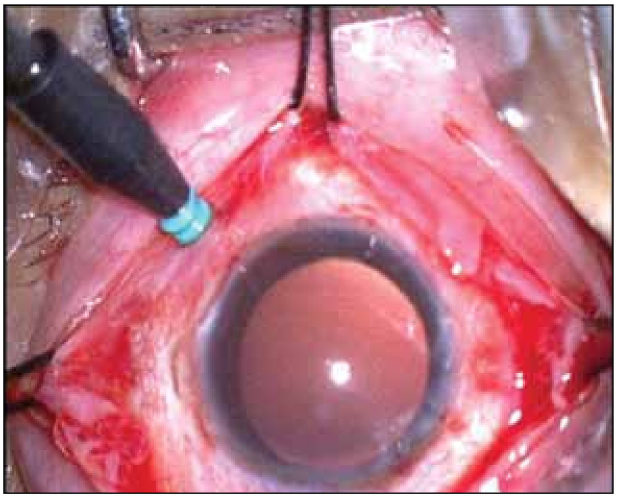

Figure 1. Placement of 25-gauge chandelier light.

In recent years, a shift in the choice of methods can be observed, with a clear trend toward PPV. Improvements in the instrumentation and safety of PPV, along with modern microscopes and wide-angle viewing systems, has enabled intraoperative visualization of retinal breaks,[14] accurate closure of all retinal breaks, and retinal reattachment in an easier and faster way. Moreover, transconjunctival sutureless vitrectomy techniques provide faster wound healing, diminished conjunctival scarring, improved patient comfort, decreased postoperative inflammation, and reduced postoperative astigmatic change.[15-23] Eliminating suturing also shortens surgical opening and closing times.[24,25]

Scleral buckling, alternatively, has the advantage of being an extraocular procedure, which, in the case of failure, is more forgiving than vitrectomy because PVR develops more quickly in patients who have undergone vitrectomy as a primary procedure compared with buckling. Although scleral buckling is technically easier,

Figure 2. Placing the widefield contact lens on the cornea.

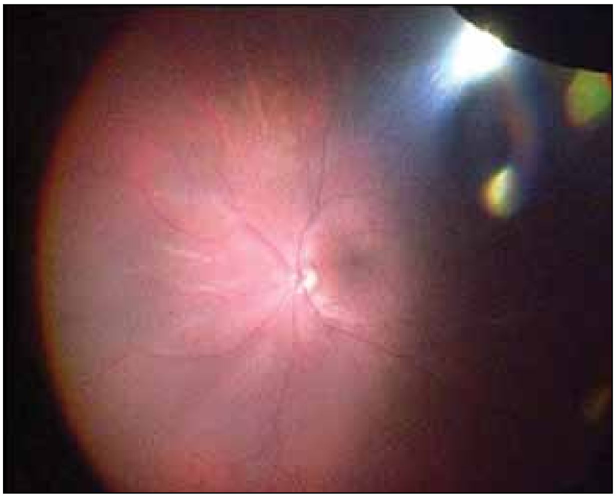

Figure 3. View of the fundus through the contact lens.

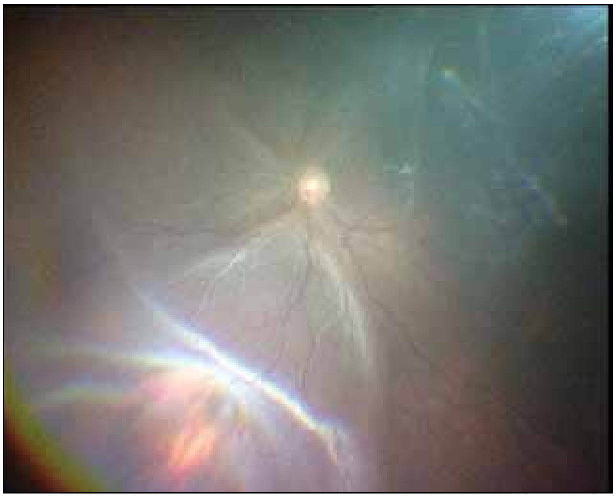

Figure 4. Localization of the retinal break.

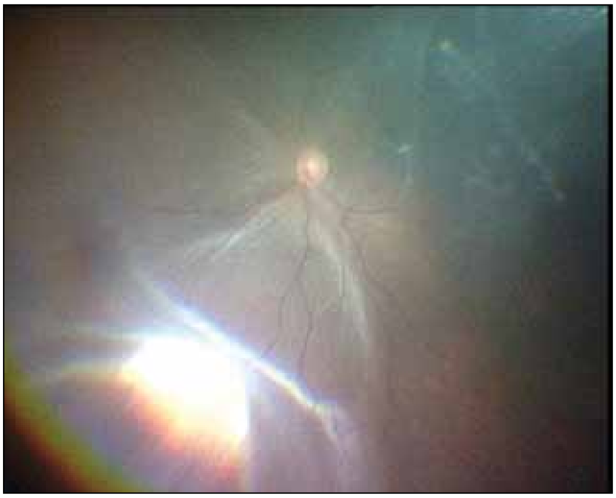

Figure 5. Cryopexy is performed.

it requires accurate decision-making for appropriate case selection, solid surgical experience, and mentors who are well versed in the procedure to advise in terms of the most effective surgical elements. Scleral buckling also requires practice to visualize and localize the breaks, to place the elements in the correct location with the desired indentation to support the retinal breaks and to drain subretinal fluid without complications. In short, scleral buckling is vastly different from microscope-based ophthalmic surgery and has a significant learning curve.

Because primary vitrectomy is now the procedure of choice for most surgeons, the present generation of fellowship training programs does not provide adequate access to buckling procedures, limiting the experience that is required to achieve sufficient confidence with buckling procedures. The visualization systems and their optical zooming capability in vitrectomy surgery are far superior to that of indirect ophthalmoscopy, and thus it is easy to teach vitrectomy with real-time video transmission facilities. New generation chandelier systems have improved the field and quality of resolution, thus allowing the surgeon an unrestricted view of the extreme periphery when used in conjunction with widefield viewing systems.[26,27]

Hence, we would like to introduce a concept that would allow us to perform scleral buckling in noncomplex fresh retinal detachments without using an indirect ophthalmoscope; rather, we propose the use of the same visualization systems used for vitrectomy procedures. A similar concept has been reported earlier in the form of using noncontact visualization systems.[28,29] In this article, we present a series of cases in which patients underwent scleral buckling under microscope using the HRX Vit SSV lens (Volk) with a single 25-gauge chandelier (Alcon Laboratories, Inc.) for illumination.

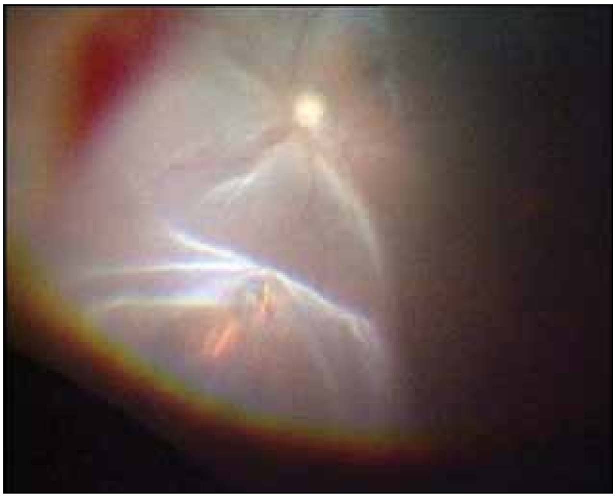

Figure 6. Localization of the posterior margin of the break.

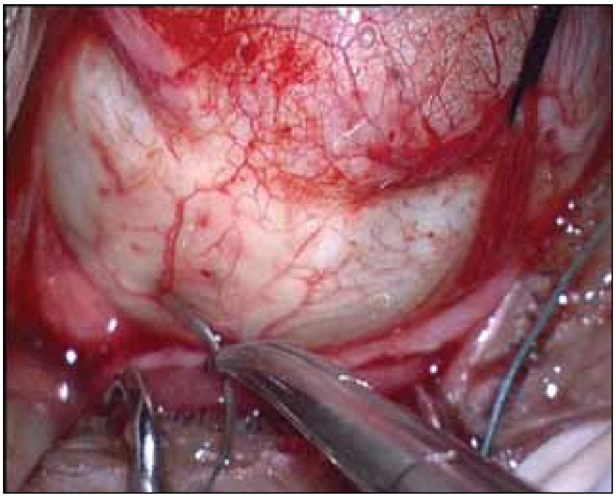

Figure 7. External sutures being inserted for buckle placement.

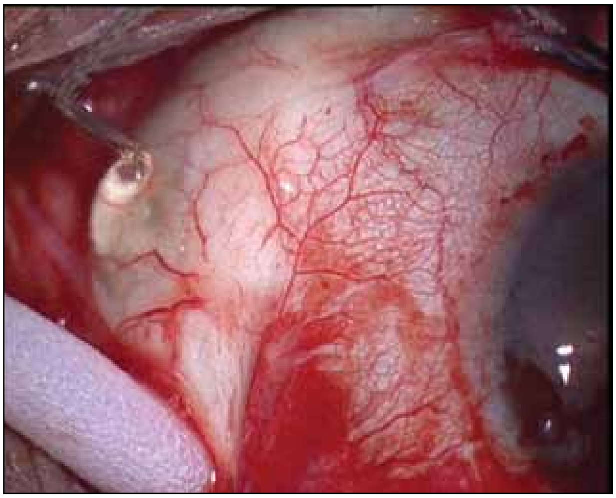

Figure 8. External drainage of subretinal fluid.

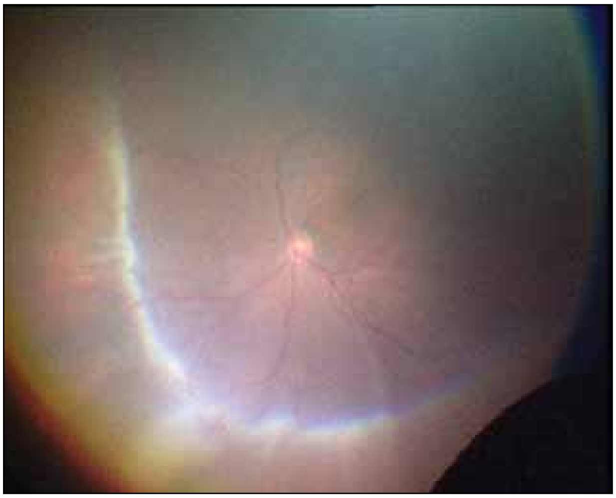

Figure 9. Buckle effect noted after drainage.

MATERIALS AND METHODS

We prospectively assessed 10 eyes (10 patients) undergoing scleral buckling for primary rhegmatogenous retinal detachment with chandelier illumination system for retinal detachment at our institution over a 6-month period. Ethical approval was obtained, and informed consent to participate was gained from participants.

Patients with rhegmatogenous retinal detachment of recent onset having peripheral break or breaks were included in the study. Patients with media opacities, such as vitreous hemorrhage or significant cataract, and any coexisting ocular pathology, such as glaucoma and uveitis, were excluded.

Following enrollment, all patients underwent complete preoperative assessment including Snellen best-corrected visual acuity. Slit-lamp examination was also performed, including assessment of the anterior segment, type and position of IOL, integrity of the posterior capsule, and intraocular pressure (IOP) measurement. Fundus examination with slit-lamp biomicroscopy and indirect ophthalmoscopy was performed to evaluate the extent of retinal detachment and the presence of any predisposing pathologic features in the peripheral retina. The fundus/slit-lamp exam was also used to grade PVR, to detect signs of myopic degeneration, to locate retinal breaks, and to determine their location, type, and number. Detailed history of coincidental and past systemic and ocular pathologies and procedures was elucidated.

All patients were operated under peribulbar anesthesia. After a 360° limbal peritomy, traction sutures were passed under the rectus muscles. Sclerotomy for chandelier illumination was created with a 25-gauge Edgeplus trocar (Alcon Laboratories, Inc.) at 3.5 and 4 mm posterior to the limbus for pseudophakic and phakic patients respectively in the inferotemporal quadrant (Figure 1).

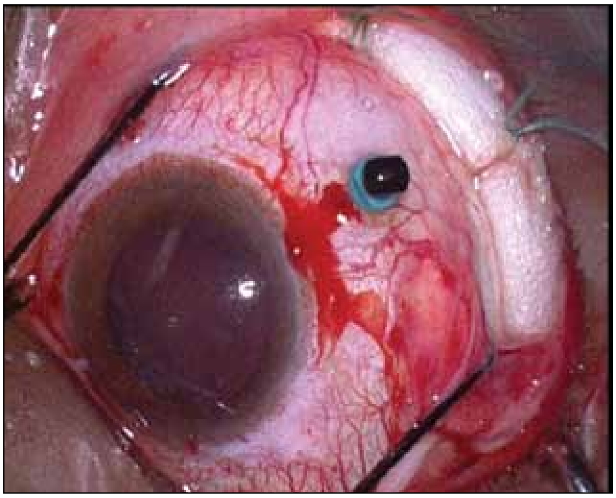

Figure 10. External buckle sutured and chandelier cannula plugged prior to closing the case.

The fiberoptic was connected to either a Constellation (xenon) or Accurus (halogen) vitrectomy system (Alcon Laboratories, Inc.). The Trocar Fixation Plate (ASICO) was used to stabilize the globe while making the biplanar incision. Initially, the blade was inserted obliquely into the sclera at an angle of about 30° to 45° up to the cannula mark. The direction of the blade was then adjusted perpendicular to the sclera as it was inserted into the vitreous cavity. Once the chandelier was inserted, the widefield viewing contact lens was placed on the corneal surface with viscoelastic interface (Figure 2). Once visualization was achieved, the image was reinverted using the invertor attached on the microscope. Detailed assessment of the fundus was done using indentation, and the break or breaks were localized (Figures 3 and 4). Cryopexy of the breaks and all the suspicious areas was performed (Figure 5 and 6). A 5-mm silicone sponge (type 506; Labtician Ophthalmics, Inc.) was passed beneath the rectus muscles and fixed with a polyester 5-0 suture placed in the sclera so that the buckle indented the site of the break and sat at 1 clock hour on either side, 3 mm posterior and 2 to 3 mm anterior (Figure 7). The decision to use a segmental buckle was made according to the size and location of the retinal tear. Subretinal fluid was externally drained through a sclerotomy with a 24-gauge needle after diathermy to the sclerotomy site (Figure 8). Full drainage was achieved in all cases and was visually confirmed with a microscope. At this stage, the fundus was checked to confirm retinal flattening along with the desired indentation effect (Figure 9). The remaining sutures were removed externally, and the chandelier light cannula was plugged (Figure 10) and eventually removed. The sclerotomy was sutured with 8-0 polyglactin. A drop of povidone-iodine was then instilled followed by conjunctival closure with 8-0 polyglactin and subconjunctival antibiotic injection.

Patients were examined postoperatively on days 1, 30, 90, and 180. During each visit, a detailed ophthalmic examination was carried out. Anatomic and functional status of the retina were assessed and IOPs were checked on all visits.

RESULTS

All patients were followed up for a minimum duration of 6 months. Nine out of 10 patients had fully attached retinas at all follow-ups with visual improvement. One patient who was stable on first postoperative day presented with redetachment at 1-month follow-up. The horseshoe tear seemed to be on the buckle, but there was a significant collection of fluid, and so we performed vitrectomy. We found a macular hole that was responsible for this fluid. The patient had myopia with tessellated fundus and staphylomatous changes, which may have been the reason that the macular hole was not detected at the time of the first surgery. Alternatively, the macular hole may have occurred secondarily during the follow-up period. The vitrectomy resulted in stabilization of the eye in this patient.

To watch buckling surgery under chandelier illumination, scan the QR code in this article or follow the link to www.eyetube.net.

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DISCUSSION

Scleral buckling surgery is on the decline due to the lack of training for this procedure, which requires experience in technique and decision-making. Most fellowship programs train surgeons in vitrectomy techniques as primary procedures, even though many cases would be successfully treated with buckling alone. This is particularly true for younger and phakic patients, who may benefit because the vitreous is frequently only partially detached, with attachment around the edges of the lattice degeneration. Although PPV can be used in these cases, often the vitreous cannot be effectively removed from the periphery or around these areas of lattice degeneration. The vitreous can be shaved close to the surface of the retina, but postoperative contraction of remaining vitreous is common. The adhesive force of the laser scar may not overcome the contractile force of fibrous proliferation. Also, shaving the vitreous closely in the setting of a retinal detachment often leads to iatrogenic breaks. Multiple reports of PPV alone for rhegmatogenous retinal detachment showed anatomic success rates in the range of 70 to 80%.[30-33] Another concern is that the surgeon who avoids scleral buckling for the initial repair is likely to attempt the same approach for repair of redetachment, with a greater dependence on retinectomy and silicone oil tamponade than if a buckle were added.

The disadvantages of PPV vs scleral buckling surgery include the need for postoperative positioning, restriction of air travel, potential for endophthalmitis, possible complications of draining retinotomies, and secondary cataract in phakic patients. Additionally, the incidence of PVR after primary vitrectomy in the treatment of retinal detachment has been reported to be as high as 6% in uncomplicated cases and between 11 and 16% in more complicated cases.[34,35] Cost is also an important factor because vitrectomy uses expensive equipment. Scleral buckling, however, is a low-budget procedure.

The results of our pilot study provide the rationale for evaluating scleral buckling in a larger series of patients to practically and more clearly explain our procedure, which is similar to a normal scleral buckling procedure with the exception that a chandelier is inserted and a widefield contact lens is used instead of an indirect ophthalmoscope. The ability to transmit the surgery to an OR monitor to see every step in fine detail is a significant improvement over operating with an indirect ophthalmoscope, and it may help train surgeons in their process of decision-making during a procedure (ie, localization, cryotherapy, external drainage). We believe that our technique should be easily adoptable by most vitreoretinal surgeons who are familiar with using widefield visualization and that it may help to propagate the art of scleral buckling, which provides excellent results in carefully selected cases. ■

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1. Custodis E. Treatment of retinal detachment by circumscribed diathermal coagulation and by scleral depression in the area of tear caused by imbedding of a plastic implant [in German]. *Klin Monbl Augenheilkd Augenarztl Fortbild.* 1956;129(4):476-495.
2. Schepens CL, Okamura ID, Brockhurst RJ. The scleral buckling procedures, I: surgical techniques and management. *Arch Ophthalmol.* 1957;58(6):797-811.
3. Machemer R, Buettner H, Norton EW, Parel JM. Vitrectomy: a pars plana approach. *Trans Am Acad Ophthalmol Otolaryngol.* 1971;75(4):813-820.
4. Machemer R, Allen AW. Retinal tears 180 degrees and greater: management with vitrectomy and intravitreal gas. *Arch Ophthalmol.* 1976;94(8):1340-1346.
5. Michels RG. Vitrectomy techniques in retinal reattachment surgery. *Ophthalmology.* 1979;86(4):556-585.
6. Hutton WL, Snyder WB, Vaiser A. Vitrectomy in the treatment of ocular perforating injuries. *Am J Ophthalmol.* 1976;81(6):733-739.
7. Peyman GA, Huamonte FU, Rose M. Management of traumatic retinal detachment with pars plana vitrectomy, scleral buckling, and gas injection. *Acta Ophthalmol (Copenh).* 1975;53(5):731-737.
8. Michels RG. Surgery of retinal detachment with proliferative vitreoretinopathy. *Retina.* 1984;4(2):63-83.
9. Hanneken AM, Michels RG. Vitrectomy and scleral buckling methods for proliferative vitreoretinopathy. *Ophthalmology.* 1988;95(7):865-869.
10. de Bustros S, Michels RG. Surgical treatment of retinal detachments complicated by proliferative vitreoretinopathy. *Am J Ophthalmol.* 1984;98(6):694-699.
11. Devenyi RG, de Carvalho Nakamura H. Combined scleral buckle and pars plana vitrectomy as a primary procedure for pseudophakic retinal detachments. *Ophthalmic Surg Lasers.* 1999;30(8):615-618.
12. Gartry DS, Chignell AH, Franks WA, Wong D. Pars plana vitrectomy for the treatment of rhegmatogenous retinal detachment uncomplicated by advanced proliferative vitreoretinopathy. *Br J Ophthalmol.* 1993;77(4):199-203.
13. Han DP, Mohsin NC, Guse CE, Hartz A, Tarkanian CN. Comparison of pneumatic retinopexy and scleral buckling in the management of primary rhegmatogenous retinal detachment. Southern Wisconsin Pneumatic Retinopexy Study Group. *Am J Ophthalmol.* 1998;126:658-668.
14. Chalam K, Shah V. Optics of Wide-Angle Panoramic Viewing System–Assisted Vitreous Surgery. *Surv Ophthalmol.* 2004;49(4):437-445.
15. Chen JC. Sutureless pars plana vitrectomy through self-sealing sclerotomies. *Arch Ophthalmol.* 1996:114:1273-1275.
17. Milibak T, Suveges I. Complications of sutureless pars plana vitrectomies through self-sealing vitrectomies. *Arch Ophthalmol.* 1998;116:119.
18. Kwok AK, Tham CC, Lam DS, et al. Modified sutureless sclerotomies in pars plana vitrectomies. *Am J Ophthalmol.* 1999;127:731-733.
19. Schmidt J, Nietgen GW, Breiden S. Self sealing sutureless sclerotomy in pars plana vitrectomy. *Klin Monatsbl Augenheilkd.* 1999;215:247-251.
20. Jackson T. Modified sutureless sclerotomy in pars plana vitrectomy. *Am J Ophthalmol.* 2000;129:116-117.
21. Assi AC, Scott RA, Charteris DG. Reversed self sealing pars plana sclerotomies. *Retina.* 2000;20:689-692.
22. Rahman R, Rosen PH, Ridell C, Towler H. Self sealing sclerotomies foe sutureless pars plana vitrectomies. *Ophthalmic Surg Laser.* 2000;31:462-466.
23. Theelen T, Verbeek AM, Tilanus MA, Van den beisen PR. A novel technique for self sealing sutureless pars plana sclerotomies and its future in ultrasound biomicroscopy and clinical outcomes. *Am J Ophthalmol.* 2003;136:1085-1092.
24. Yanyali C, Celik E, Horozoglu F, Nohotcu AF. Corneal topographic changes after 25 gauge sutureless vitrectomy. *Am J Ophthalmol.* 2005;140:939-941.
25. Lakhanpal, Humayun MS, Dejuan E Jr, et al. Outcomes of 140 consecutive cases of 25 g transconjunctival surgeries for posterior segment disease. *Ophthalmology.* 2005;112:817-824.
26. Nagpal M, Wartikar S, Nagpal K. Comparison of clinical outcomes and wound dynamics of sclerotomy ports of 20, 25 and 23 gauge vitrectomy. *Retina.* 2009;29:225-231.
27. Oshima Y, Awh CC, Tano Y. Self-retaining 27-gauge transconjunctival chandelier endoillumination for panoramic viewing during vitreous surgery. *Am J Ophthalmol.* 2007;143:166-167.
28. Nawrocki J, Michalewska Z, Michalewski J. Optic fibre free intravitreal surgical system (OFFISS) in retinal detachment surgery. *Ophthalmic Surg Lasers Imaging.* 2008;45:466-470.
29. Aras C, Ucar D, Koytak A, Yetik H. Scleral buckling with a non-contact wide-angle viewing system. *Ophthalmologica.* 2012;227(2):107-110.
30. Oshima Y, Chow DR, Awh CC, et al. Novel mercury vapor illuminator combined with a 27/29-gauge chandelier light fiber for vitreous surgery. *Retina.* 2008;28:171-173.
31. Heimann H, Zou X, Jandeck C, et al. Primary vitrectomy for rhegmatogenous retinal detachment: an analysis of 512 cases. *Graefes Arch Clin Exp Ophthalmol.* 2006;244(1)69-78.
32. Dugas B, Lafontaine PO, Guillaubey A, et al. The learning curve for primary vitrectomy without scleral buckling for pseudophakic retinal detachment. *Graefes Arch Clin Exp Ophthalmol.* 2009;247(3):319-324.
33. Oyagi T, Emi K. Vitrectomy without scleral buckling for proliferative vitreoretinopathy. *Retina.* 2004;24(2):215-218.
34. Hakin KN, Lavin MJ, Leaver PK. Primary vitrectomy for rhegmatogenous retinal detachment. *Graefes Arch Clin Exp Ophthalmol.* 1993;231(6):344-346.
35. Escoffery RF, Olk RJ, Grand MG, Boniuk I. Vitrectomy without scleral buckling for primary rhegmatogenous retinal detachment. *Am J Ophthalmol.* 1985;99(3):275-281.

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☐ Yes
☐ No

Would having chandelier illumination available increase the number of scleral buckle procedures you perform?

☐ Yes
☐ No