Scleral Buckling for Rhegmatogenous Retinal Detachment Using Vitrectomy-Based Visualization Systems and Chandelier Illumination

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Purpose: The objective of this study was to evaluate an alternative approach to scleral buckling surgery using vitrectomy-based chandelier visualization systems instead of the indirect ophthalmoscope.
Design: This was a prospective case series.
Methods: Ten eyes underwent scleral buckling under microscope using contact wide-angle lens with 25-gauge chandelier illumination and were followed up for 6 months.
Results: An encirclage was done in 8 eyes, and segmental buckle used in 2 eyes. Excellent intraoperative visualization was achieved, and all routine buckling steps were easily replicated with this approach.
Conclusions: Using contact wide-angle lens along with chandelier illumination under microscope allows good visualization for scleral buckling procedure. This approach may allow excellent visibility with zooming capabilities for each step of the procedure as well as allows transmission to a monitor in the theater for teaching purposes apart from allowing better ergonomics for the surgeon.

Key Words: scleral buckling, rhegmatogenous retinal detachment, vitrectomy-based visualization systems, chandelier illumination

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Scleral buckling (SB) was first performed as a technique to repair rhegmatogenous retinal detachment (RD) by Custodis[1] in 1949 and was popularized in the 1950s.[2] However, soon after the introduction of pars plana vitrectomy (PPV) in the early 1970s by Machemer et al,[3] it enhanced the ability to repair RDs, 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 RDs, particularly in patients with pseudophakic eyes.[11,12]

Apart from vitrectomy and SB, another procedure, pneumoretinopexy, has also been used in specific configurations of RDs with breaks located superiorly, although associated with a significantly higher reoperation rate than SB, but equivalent final visual outcome and reattachment rate after reoperations.[13]

Although the standard approach to management of rhegmatogenous RDs has been buckling surgery, in recent years, a shift in the choice of approach has been observed, with a definite trend toward PPV. Improvements in the instrumentation and safety of PPV along with modern microscopes and wide-angle viewing systems have enabled intraoperative visualization of retinal breaks[14] and allowed the surgeon to accurately close all the retinal breaks and reattach the retina 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 time.[24,25]

Moreover, the optical zooming capabilities of wide-field visualization systems in vitrectomy surgery are far superior to that of indirect ophthalmoscopy, thereby making it is easier to teach vitrectomy with real-time video transmission facilities, which has resulted in primary vitrectomy being more popular as a procedure of choice among the present generation of ophthalmologists. In addition, new-generation chandelier systems have complemented the field and quality of resolution, thus allowing the surgeon an unrestricted view of the extreme periphery when used in conjunction with wide-field viewing systems.[26,27] On the other hand, SB, although technically easier, requires an accurate decision making for appropriate case selection, which may prove critical to the surgical success, hence takes experience with a multitude of cases and experienced mentors to feel comfortable with selection of the most effective elements.[28] It also requires practice to visualize and localize the breaks, to place the SB elements in the correct location with the desired indentation to support the retinal breaks and to drain subretinal fluid without complications. It is very different from microscope-based ophthalmic surgery, and there is a significant learning curve to it.

Hence, we would like to introduce a concept that would allow us to do SB using vitrectomy-based wide-field contact lens viewing systems without the limitations of indirect ophthalmoscopy-based viewing.

A similar approach has been mentioned earlier that involves using noncontact visualization systems by Nawrocki et al[29] and Aras et al.[30]

We present a series of cases that underwent SB under microscope using Volk HRX Vit SSV lens (VOLK, Mentor, Ohio) using a single 25-gauge chandelier (ALCON, Fort Worth, Tex) for illumination.

MATERIALS AND METHODS

We prospectively assessed 10 eyes (10 patients) undergoing SB for primary rhegmatogenous RD with chandelier illumination system for RD at Retina Foundation over a 6-month period. Ethical approval was obtained and informed consent to participate was gained from participants.

Patients with rhegmatogenous RD of recent onset having peripheral break/s 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 enrolment, all patients underwent complete preoperative assessment including best corrected visual acuity

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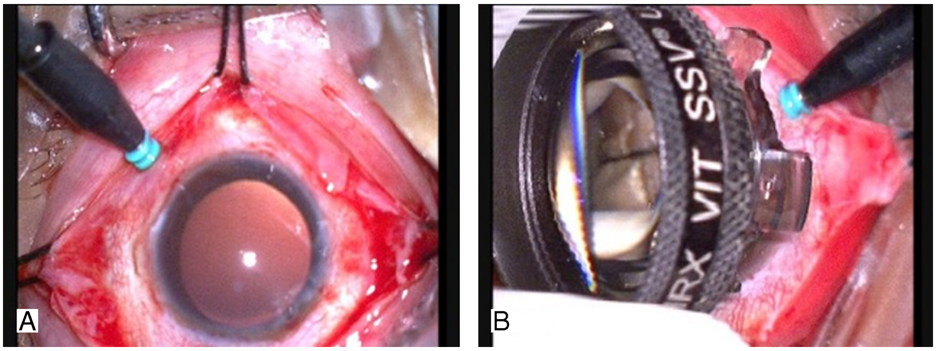

FIGURE 1. A, A 25-gauge chandelier inserted in the inferotemporal quadrant. B, Placement of wide-field viewing contact lens on corneal surface with viscoelastic interface.

(Snellen), relative afferent pupillary defect in the affected eye, and refraction of the fellow eye; slit-lamp examination, including assessment of the anterior segment, type, and position of intraocular lens and integrity of the posterior capsule; and intraocular pressure measurement. Fundus examination with slit-lamp biomicroscopy and indirect ophthalmoscopy was performed to evaluate the extent of RD, the presence of any predisposing pathologic features in the peripheral retina, PVR grading, and signs of myopic degeneration and to find retinal breaks and to determine their location, type, and number. Detailed history of coincidental and past systemic and ocular pathologies and procedures were elucidated.

All patients were operated on under peribulbar anesthesia. After a 360-degree limbal peritomy, traction sutures were passed under the rectus muscles. Sclerotomy for chandelier illumination was created with 25-gauge Edgeplus trocar (ALCON) at 3.5 and 4 mm posterior to the limbus for pseudophakic and phakic patients, respectively, in inferotemporal quadrant (Fig. 1A). The fiberoptic was connected to either a Constellation (Xenon) or Accurus (Halogen) vitrectomy systems (ALCON). The Trocar Fixation plate (Asico, Westmont, Ill) 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 degrees up to the cannula mark. Then, the direction of the blade was adjusted perpendicular to the sclera as it is inserted into the vitreous cavity. Once the chandelier was inserted, the wide-field viewing contact lens was placed on corneal surface with viscoelastic interface (Fig. 1B). 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/s was localized (Fig. 2A). Cryopexy of the breaks and all the suspicious areas was performed (Fig. 2B). Silicone sponge 5 mm 506 (LABTICIAN Ophthalmics, Inc, Oakville, Ontario, Canada) was passed beneath the rectus muscles and fixed with Mersilene 5.0 suture placed in the sclera such that the buckle indented the site of the break and 1 clock hour on either side, 3 mm posterior and 2 to 3 mm anterior to it (Fig. 2C). 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 (Fig. 3a). Full drainage was achieved in all cases, and visual confirmation was done by checking under the microscope. At this stage, the fundus was checked to confirm retinal flattening along with the desired indentation effect (Fig. 3B). Externally, the remaining sutures were taken. The chandelier light cannula was plugged (Fig. 3C) and eventually removed, and the sclerotomy was sutured with 8-0 Vicryl suture. A drop of povidone-iodine is then instilled followed by conjunctival closure with 8-0 Vicryl and subconjunctival antibiotic injection. All surgeries were transmitted real time to the viewing monitor within the theater for visibility to fellows/assistants, and the entire surgical procedure was recorded for teaching and training purposes.

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

RESULTS

A total of 10 patients were included in the study, of which 7 were phakic, 2 pseudophakic, and 1 aphakic eye. The RD involved more than 2 quadrants in 5 eyes (50%). There was total RD in 4 eyes (40%). The macula had been spared in the RD at presentation in 1 eye (10%). An encirclage was done in 8 eyes, and segmental buckle used in 2 eyes. Subretinal fluid was drained in all cases. All patients were followed up for a minimum duration of 6 months. There were no instances of

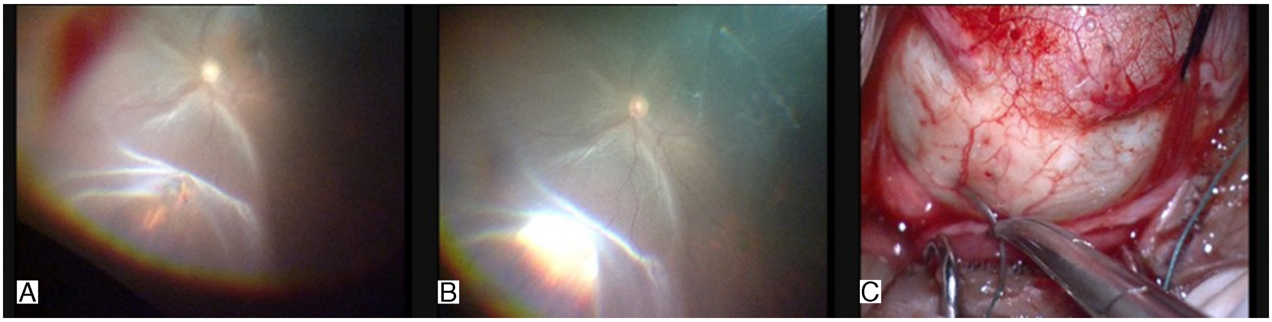

FIGURE 2. A, External indentation and localization of break. B, Cryopexy being done on the break. C, Sutures for the plomb being taken.

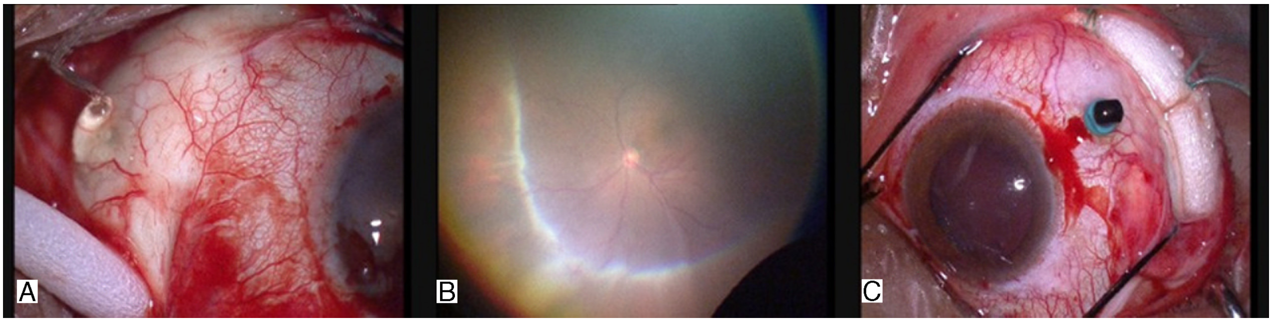

FIGURE 3. A, Subretinal fluid (SRF) externally drained through a sclerotomy. B, Visualization of the indentation effect. C, Chandelier light cannula plugged before removal.

postoperative endophthalmitis in this series. Nine of 10 patients had fully attached retina at all follow-ups with visual improvement. One patient who had settled on table and stable on first postoperative day presented with redetachment on the first-month follow-up. The horseshoe tear seemed to be well on the buckle, but there was a significant collection of fluid, and hence a vitrectomy was undertaken. On the table, we found a macular hole, which was responsible for this fluid. Patient was a myope with tessellated fundus and staphylomatous changes, and hence a small macular hole could have been missed at the time of first surgery or could have developed secondarily during the follow-up period. However, after a vitrectomy, the retina settled well. The mean preoperative best corrected visual acuity of 1.3 logmar improved postoperatively to 0.48 at the end of 6 months.

DISCUSSION

The type of surgical procedure used for rhegmatogenous RD 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.

Buckling surgery is on the decline as the technique requires a certain number of volumes under trained supervision and decision making to be successful. Because the numbers of buckling procedures are getting less, and the teaching programs are not able to give adequate number of these procedures to training fellows, most of them become well versed with vitrectomy for all cases. They do not get the requisite confidence to do buckling in cases that could easily settle with a buckle alone. This would specifically make a difference in younger patients where the long-term intraocular complications would be much less with buckling.

Multiple reports of PPV alone for rhegmatogenous RD showed anatomic success rates in the range of 70% to 80%.[31–34] Among the disadvantages of PPV in comparison with buckling surgery are narrow margin of error to minimize that requires extensive training, need for postoperative positioning and restriction of air travel, the potential for endophthalmitis, the possible complications of draining retinotomies, and secondary cataract in phakic patients.

Besides, the incidence of PVR as complication of primary vitrectomy in the treatment RD has been reported as between 11% and 16%, and in uncomplicated cases as 6%.[35,36]

Scleral buckling, on the other hand, has the advantage of being an extraocular procedure, which is also, in the case of failure, more forgiving than vitrectomy because PVR develops more quickly in cases that have undergone vitrectomy as a primary procedure as compared with buckling.

Nawrocki et al[29] have demonstrated the use of the OFFISS (Optic Fibre Free Intravitreal Surgical System) (Topcon Inc, Paramus, NJ) in SB performed as a complete microsurgical procedure in 7 eyes with rhegmatogenous RD. It provides a visual field of approximately 50 degrees inside the eye, which is smaller than a wide-angle viewing system.[37] Moreover, the best-quality images may be achieved in aphakic eyes.

Aras et al[30] have described the outcomes of SB surgery using a noncontact wide-angle viewing system combined with a 25-gauge illumination fiber inserted into the sclera at the pars plana for fundus visualization in 16 patients with rhegmatogenous RD without PVR. Non–contact-based systems are known to have distortion of view in extreme periphery because of the mismatch of the microscope's visual axis and the movement of the eyeball in extreme movements while indenting the periphery.

In comparison, the contact Volk HRX Vit SSV lens that we have used provides a much wider view (150 degrees), giving an advantage for visualizing peripheral breaks. This contact lens works equally well in phakic, aphakic, and pseudophakic eyes. Moreover, there is minimal distortion in the periphery while indenting because the lens moves along with the cornea unlike the noncontact systems.[38]

The time duration of the surgery is not different as compared with the standard indirect ophthalmoscopy-based surgery. The chandelier fiberoptic is placed in the temporal aspect and usually does not come in the way of movements for most part of the surgery. However, while taking sutures in the temporal quadrants, the fiberoptic can come in the way of the needle holder, and hence we improvised by removing the fiberoptic and plugging the cannula for that part of the procedure. Once the suture is taken, we reintroduce the chandelier for visualization.

Moreover, because this technique involves the introduction of a cannula and chandelier, it does carry a higher risk of endophthalmitis, and due care must be taken to reduce the chances for the same with good aseptic precautions. None of the cases in our series have had endophthalmitis.

Thus, our pilot study gives us the confidence of doing a larger series and has helped us to practically explain the procedure to training fellows in a much better visual manner. The procedure of buckling by this technique is very much the same except that the chandelier is inserted, and viewing is done using wide-field contact lenses instead of an indirect ophthalmoscope. So nothing else changes for the procedure itself. But the ability to transmit the surgery to an operation theater monitor and see every step in a fine detail is a major difference than operating with indirect ophthalmoscope. This greatly helps the understanding of the fellows in decision making at every step right from localization to doing cryotherapy, decision making for external drainage, and so on. It may also have ergonomic benefits for the surgeon in the long run to do buckling procedures with the comfort of sitting on a chair and visualizing using a microscope, because while doing traditional buckling surgery the surgeon is often bending his back and neck for long hours with the strain of an indirect ophthalmoscope on the head, and it often takes a toll on the cervical and lumbar spine creating chronic disk prolapse–related problems. We feel that it should be easy to adopt this technique by most vitreoretinopathy surgeons who are familiar using wide-field visualization and may help continue to propagate the art of buckling, which to date works wonders if a good case selection is done.

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