**Introduction**

Before the turn of the twentieth century, eyes with retinal detachment (RD) were considered doomed. Contrary to other branches of ophthalmology, such as cataract extraction, the surgical treatment of retinal detachment was still in its infancy, and surgical success rates were less than five percent. From 1902 to 1921, Jules Gonin almost single-handedly changed the landscape of retinal detachment surgery forever. He recognized that retinal break was the cause and not the consequence as it was largely believed at that time. He named the procedure ‘Ignipuncture’, as he cauterized the retina through the sclera with a very hot pointed instrument.

The most difficult step in this procedure was the precise localization of the retinal break. This localization became more predictable with invention of the binocular indirect ophthalmoscope by Charles Schepens in 1947. Two major advances assisted the sealing of breaks to the Retinal Pigment Epithelium. Meyer-Schwickerath developed photocoagulation in the 1950s and Lincoff pioneered modern cryopexy in the 1960s.

Pars plana Vitrectomy (PPV) represented an entirely new approach to the treatment of rhegmatogenous RD. It was first reported by Robert Machemer in 1971. PPV for rhegmatogenous RD was augmented by three other innovations: silicone oil by Paul Cibis in 1962; fluid – air exchange by Steven Charles in 1977; and perfluorocarbon liquids by Stanley Chang.

Retinal detachment occurs in 25,000 Americans each year. Patients suffering from RD are commonly nearsighted, have had eye surgery, experienced ocular trauma, or have a family history of retinal detachments. Retinal detachments also are common after cataract removal. White males are at a greater risk, as are people who are middle-aged or older. Patients who already have had a retinal detachment also have a greater chance for another detachment.

Some conditions, such as diabetes or Coats’ disease in children, make people more susceptible to retinal detachments.

**Scleral Buckling in the management of Retinal Detachment**

Scleral buckling is a surgical procedure in which a piece of silicone plastic or sponge is sewn onto the sclera at the site of a retinal tear to push the sclera toward the retinal tear. The buckle holds the retina against the sclera until scarring seals the tear. It also prevents fluid leakage which could cause further retinal detachment.

Scleral buckles come in many shapes and sizes. An encircling band is a thin silicone band sewn around the circumference of the sclera of the eye. Buckles are often placed under a band to create a dimple on the eye wall.

The scleral buckle is secured around the eyeball under the conjunctiva. This moves the wall of the eye closer to the detached retina. It also may move the retina closer to the vitreous. This alteration in the relationships of the tissues seems to allow the fluid which has formed under the retina to be pumped out, and the retina to re-attach.

**Evolution of Pars Plana Vitrectomy**

In the earlier days, Vitrectomy was performed in cases in which the surgeon’s view of the damage was hindered. The surgeon makes three incisions into the sclera, one for an infusion, one for a light probe and the third for instruments to cut and aspirate. The surgeon uses a tiny, guillotine-like device to remove the vitreous, which he then replaces with saline. After the removal, the surgeon may inject air or gas to hold the retina in place.

After, the surgeon is able to see the retina, he or she will perform one of two companion procedures.

- **Laser photocoagulation.** The laser is used when the retinal tear is small or the detachment is slight. The surgeon points the laser beam through a contact lens or a non contact viewing system to burn the area around the retinal tear. The laser creates scar tissue that will seal the hole and prevent leakage. It requires no incision.

- **Cryopexy.** Using a freezing probe, the surgeon freezes the outer surface of the eye over the tear or detachment. The inflammation caused by the freezing leads to scar formation that seals the hole and prevents leakage. Cryopexy is used for larger holes or detachments, and for areas that may be hard to reach with a laser.

After the surgeon has performed laser photocoagulation or cryopexy, he or she indents the affected area of the sclera with silicone. The silicone, either in the form of a sponge or buckle, closes the tear and reduces the eyeball’s circumference. This reduction prevents further pulling and separation of the
vitreous. Depending on the severity of the detachment or hole, a buckle may be placed around the entire eyeball.

When the buckle is in place, the surgeon may drain subretinal fluid that might interfere with the retina’s reattachment. After the fluid is drained, the surgeon will suture the buckle into place and then cover it with the conjunctiva.

**Temporary Buckles**

For less severe detachments, the surgeon may choose a temporary buckle that will be removed later. Usually, however, the buckle remains in place for the patient’s lifetime. It does not interfere with vision. Scleral buckles in infants, however, will need to be removed as the eyeball grows.

Best visual acuity cannot be determined for at least six to eight weeks after surgery. Full vision restoration depends on the location and severity of the detachment.

Scar tissue, even pre-existing scar tissue, may interfere with the retina’s reattachment and the scleral buckling procedure may have to be repeated. Scarring, along with infection, was the most common complication.

Other possible but infrequent complications include:

- bleeding under the retina
- cataract formation
- double vision
- glaucoma
- vitreous hemorrhage

Patients may also become more nearsighted after the procedure. In some instances, although the retina reattaches, vision is not restored.

The National Institutes of Health reports that scleral buckling has a success rate of 85–90%. Restored vision depends largely on the location and extent of the detachment, and the length of time before the detachment was repaired. Patients with a peripheral detachment have a quicker recovery than those patients whose detachment was located in the macula. The longer the patient waits to have the detachment repaired, the worse the prognosis.

The danger of mortality and loss of vision depends on the cause of the retinal detachment. Patients with Marfan syndrome, pre-eclampsia and diabetes, for example, are more at risk during the scleral buckling procedure than a patient in relatively good health. The risk of surgery also rises with the use of general anesthesia. Scleral buckling, however, is considered a safe, successful procedure.

Scleral buckling is a standard surgical method to manage RD after cataract surgery. Nevertheless, the outcomes of sclera buckling in aphakic and pseudophakic eyes generally are less favorable than in phakic eyes. The range of anatomic success varies from 61.5% to 80% in case of pseudophakic and aphakic RD managed by Scleral buckling. Undiagnosed retinal breaks are an important cause of failure in these cases resulting from the smaller size and anterior location of retinal breaks as well as incomplete fundus view because of anterior or posterior capsular fibrosis, cortical remnants, poor papillary dilatation, vitreous opacities, and optical aberrations secondary to intraocular lens itself. In addition to unseen retinal breaks, proliferative vitreoretinopathy has been shown to occur more frequently in pseudophakic and aphakic RD.

**Pars Plana Vitrectomy as a Primary Procedure for repair of Retinal Detachment**

Advances in vitrectomy technique have encouraged vitreoretinal surgeons to expand the role of primary pars plana vitrectomy in the management of uncomplicated RDs. Primary vitrectomy especially has been considered as first line surgical treatment in cases of pseudophakic and aphakic RD. The rationale for such an approach includes the ability to remove retained lens material, vitreous opacities, and retinal pigment epithelial cells, while allowing controlled drainage of subretinal fluid. Other potential advantages of primary vitrectomy in these cases may be the ability to visualize small retinal breaks with or without simultaneous sclera depression and application of retinopexy. The absence of risk of cataract formation is another reason for surgeons’ tendency to perform primary vitrectomy in aphakic and pseudophakic eyes.

Ahmadieh et al designed a multicenter controlled clinical trial to compare the anatomic and visual outcomes of sclera buckling with primary vitrectomy alone in pseudophakic and aphakic RD. The results showed no statistically significant differences between the 2 treatment groups regarding the single – operation retinal reattachment rate 6 month follow up examinations. Patients in the buckle group had 28% greater likelihood of anatomic success compared with those in the vitrectomy group indicating no statistically significant difference. Proliferative vitreoretinopathy was the main cause of anatomic failure in both groups and occurred independent of the surgical technique used. Final best corrected visual acuity showed no statistically significant difference between the 2 groups. There were no statistically significant differences in rates of complications.

The relationship between myopic RD and surgical success has been in dispute. Burton and Lambert reported a somewhat lower success rate in eyes with more than 4D of myopia. Eyes with high myopia may have a slightly lower success rate when managed by scleral buckling. This in part results from an increased risk of complications during placement of scleral sutures because of marked scleral thinning and an
increased risk of choroidal hemorrhage during drainage of subretinal fluid. However, high myopia has been mentioned as a risk factor for supra choroidal hemorrhage during pars plana vitrectomy.

Isemhagen and Wilkinson evaluated the effect of preoperative factors on final visual acuity after repair of pseudophakic RD with scleral buckling. Preoperative visual acuity was the most important variable. Macular involvement is an important factor influencing vision after RD surgery. Duration of macular involvement is one of the most important variables associated with return of central vision. There is a significant decrease in visual recovery with macula off detachment lasting longer than 1 week.

Macular pucker is a common finding after RD surgery. It has been reported in 2% to 17% of detachment cases undergoing sclera buckling. Extensive RD and involvement of macula have been noted to be associated with development of macular pucker. Macular pucker also has been reported as a frequent complication of primary vitrectomy for pseudophakic and aphakic RD.

Refractive error changes after RD surgery can result in anisometropia. In a study by Rubin, changes in refractive error were related to the height of the sclera buckle and were greater in phakic and aphakic eyes. Among the presumed advantages of primary vitrectomy without an encircling element over sclera buckling is the possibility of less induced anisometropia.

In most studies, early transient IOP rise was the most common complication of primary vitrectomy combined with fluid gas exchange. In the studies by Barz-Schmidt et al and Speicher et al, this rate was reported to be 48% and 17.9% respectively.

Persistent extra ocular muscle dysfunction after buckle surgery has been reported in up to 4%, and most cases occurred in eyes with an encircling element. The rate of this complication after vitrectomy was not reported in other studies.

At the end of the previous decade, with the invention of a variety of surgical techniques as substitutes for sclera buckling to repair uncomplicated RD, Wilkinson wrote an editorial entitled “Wanted: Optimal Data Regarding Surgery for Retinal Detachment.”

Primary vitrectomy without scleral buckle was not more effective than conventional sclera buckling in the management of uncomplicated RD in eyes with a history of cataract extraction. No single surgical technique can be considered as optimal and routine for all cases of rhegmatogenous RD. It is noteworthy to consider some of the following factors in selecting each of these options: the cost of these operations, experience and capabilities of vitreoretinal surgeons, and availability of proper instrumentation.

The Role of Scleral Buckling today

In children with a thick gel vitreous, scleral buckling may be considered over PPV as the primary retinal reattachment procedure. This holds good especially in traumatic retinal detachments, where very often, the break is a retinal dialysis.

In phakic adults with rhegmatogenous RD, where the media are clear and the break could be visualized, the number and location of the breaks will probably decide on the surgical technique to be adopted. A single break or breaks in a single quadrant, especially in one of the inferior quadrants, where a gas tamponade will be impractical, is best managed by scleral buckling. A retina reattached by a scleral buckling procedure is generally stable lifelong and gives a good post operative visual recovery.

‘Macula on’ retinal detachments usually do well with scleral buckling.

However, with the availability of PPV and its development as a safe surgical procedure, along with the modern Vitrectomy systems and viewing systems should prompt surgeons to go for it where one is faced with a not so clear media, non dilating pupil, proliferative vitreoretinopathy, posterior breaks, multiple breaks in different quadrants, presence of a macular hole, posterior staphyloma, giant retinal tears and presence of a tractional element.

The new generation Vitreoretinal surgeons should be adequately trained in scleral buckling surgery, or else, this simple procedure will face the danger of extinction in the years to come.

References
9. “Epidemiological study of nontraumatic phakic rhegmatogenous