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Comparison of Scleral Buckling and Vitrectomy for Retinal Detachment Resulting from Flap Tears in Superior Quadrants

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Purpose: To compare the surgical results of vitrectomy and scleral buckling for uncomplicated superior retinal detachment caused by flap tears.

Methods: Included in the study were 225 patients (225 phakic eyes) undergoing primary surgery by three surgeons between January 1990 and December 1996 for superior retinal detachment caused by flap tears (138 eyes by scleral buckling, 87 eyes by vitrectomy); all patients had been followed up for longer than 6 months after surgery. The choice of one of the two procedures was based on each surgeon's preference. The surgical outcome and the rate of complications were retrospectively compared between the two groups of eyes.

Results: Initial and final anatomical success rate were 92% and 100% after each procedure. Retinal redetachment after the initial procedure was due to new retinal breaks in 5 eyes, reopening of original breaks in 2 eyes of vitrectomy cases, and due to malpositioned buckle in 11 eyes of scleral buckling cases. Proliferative vitreoretinopathy occurred in 3 eyes of vitrectomy cases.

Conclusion: Primary vitrectomy was as successful as scleral buckling for treating superior rhegmatogenous retinal detachment. Even though the high incidence of postoperative cataract formation was the major drawback, vitrectomy had some advantages over scleral buckling. **Jpn J Ophthalmol 2001; 45:187–191**

Key Words: Posterior vitreous detachment, proliferative vitreoretinopathy, rhegmatogenous retinal detachment, scleral buckling, vitrectomy.

Introduction

While scleral buckling is an effective surgical procedure in treating uncomplicated rhegmatogenous retinal detachment, its intra- and postoperative complications cannot be ignored. Kloeti[1] in 1983 and Escoffery et al[2] in 1985 reported an excellent outcome of vitrectomy in eyes with retinal detachment caused by deeply located tears without proliferative vitreoretinopathy (PVR). Around the same time in Japan, Ogino[3–5] began introducing vitrectomy to his patients. Although vitrectomy today is certainly more widely accepted, some surgeons still remain conservative. Studies reporting the outcome and rate of complications of vitrectomy compared to scleral buckling performed by the same surgeons in the same period have been few. In our previous study, Horie et al[6] reported good results with primary vitrectomy in eyes with retinal detachment caused by deeply located tears. As we became familiar with the surgical technique, we have been using the vitrectomy approach more frequently. Initially, only those eyes with retinal detachment caused by deeply located or multiple tears were indicated for vitrectomy, but today the indication has been expanded to include eyes with detachment caused by equatorial and more anterior tears. In this study, we compared the surgical results and the rate of complications of vitrectomy and scleral buckling for treating uncomplicated superior retinal detachment caused by flap tears.

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Materials and Methods

Included in the present study were 225 patients (225 phakic eyes) undergoing primary surgery between January 1990 and December 1996 for bullous retinal detachment caused by flap tears located in superior quadrants; all patients had been followed up for longer than 6 months after surgery. Patients with PVR of grade C or greater,[7] retinal neovascularization, and vitreous opacities obscuring the view of the preoperative fundus, retinal detachment due to giant retinal tears or trauma, and aphakia or pseudophakia were excluded from this study. Patients with localized retinal detachments in which subretinal drainage was unnecessary were also excluded. Most of the surgery was performed by one of three surgeons (TH, DM, or KH). Only 5 eyes were operated on by other surgeons but one of these three surgeons always assisted the surgeon. The choice of one of the two procedures was based on each surgeon's preference. The surgical outcomes including the rate of complications were compared retrospectively between the two groups: scleral buckling group and vitrectomy group.

Scleral buckling consisted of encircling according to the D-ACE (Drainage, Air injection, Cryoretinopexy and Exoplant) procedure[8]; postoperatively, we did not restrict our patients to maintain one particular position. Vitrectomy involved releasing vitreous traction at the region of flap tears following core vitrectomy, and an attempt was made to remove as much of the peripheral vitreous as possible in combination with scleral indentation. Fluid-air exchange was performed and subretinal fluid drained from either original tears or the intentional retinotomy created at the posterior fundus outside the temporal arcade. All retinal tears were treated by either endophotocoagulation or transscleral cryotherapy. By the end of 1993, encircling using a no. 240 band placed just posterior to the muscle insertions had been combined with vitrectomy (16 eyes); since 1994, however, the combined treatment is performed only in cases with multiple lattice degeneration or tears. The crystalline lens was removed only when it was cataractous or traumatized during surgery. SF_6 (20%) gas was used for gas tamponade and the patients were instructed to maintain the prone position following surgery for the remainder of the day, but were permitted to take any position other than supine thereafter.

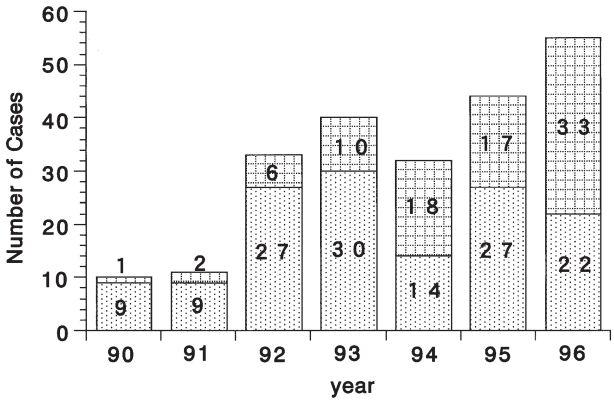

Figure 1. Number of eyes done each year by each surgical technique. top boxes, Scleral buckling; bottom boxes, vitrectomy.

Results

There were 141 male and 81 female patients, ranging in age from 27 to 77 years (mean ± SD, 51.4 ± 3.4 years). Of the 225 eyes, 138 eyes underwent scleral buckling and 87 eyes, vitrectomy. Figure 1 summarizes the number of eyes operated on by each surgical technique in each year. In the scleral buckling group, 55 eyes (39.9%) had retinal tears located at the edge of lattice degeneration and 83 eyes (60.1%) had single flap tears; in the vitrectomy group, 61 eyes (70.1%) had retinal tears and 26 eyes (29.9%) had flap tears. Multiple tears were noted in 23 eyes (16.7%) in the scleral buckling group, and in 29 eyes (33.3%) in the vitrectomy group.

In both groups, the initial and final anatomical success rates were 92% and 100%; 127 of 138 eyes in the scleral buckling group and 80 of 87 eyes in the vitrectomy group, respectively (Table 1). The initial success rate in eyes with multiple tears in the vitrectomy group was achieved in 96.6% (28/29 eyes) while that in the scleral buckling group was achieved in only 69.9% (16/23 eyes). While the difference between groups is not statistically significant, scleral buckling appeared to be less successful in treating the eyes with multiple tears.

When comparing eyes undergoing vitrectomy with and without encircling buckle, those with encircling buckle achieved an initial success rate of 100% while

Table 1. Initial and Final Success Rate in Each Group*

Success Rate	Scleral Buckling	Vitrectomy
Initial	127/138 (92)	80/87 (92)
Final	138/138 (100)	87/87 (100)

*Values in parentheses are percentages.

only 44 eyes of 51 (86.3%) without encircling buckle did so.

In 11 eyes of the scleral buckling group in which the first operation failed in reattachment, initial failure in all eyes was caused by malpositioned buckle; 7 had multiple tears and 4 had deeply located large single flap tears. In the vitrectomy group, initial failure was due to formation of new tears in 5 eyes and reopening of original breaks in 2. The former occurred during the first postoperative month and were noted to be present at the posterior edge of the vitreous base in inferior quadrants, opposite where the original tears had existed. In the 2 eyes with reopened retinal tears, in one there was formation of an epimacular membrane pulling the original break open, leading to total detachment with PVR. In the other eye, there was incarceration of the residual vitreous into the scleral wound, which then contracted and pulled the original break open.

For the eyes with initial failure, one or two (average of 1.1) reoperations were conducted in the scleral buckling group and one and more (average of 1.7) in the vitrectomy group. While none of the eyes in the scleral buckling group developed PVR after the initial surgery, 3 eyes of the vitrectomy group developed PVR and required numerous reoperations to reattach the retina, finally resulting in diminished visual outcome.

In the scleral buckling group, the incidence of intra- and postoperative complications was as follows: In 6 eyes (4.3%), subretinal hemorrhage occurred at the time of subretinal fluid drainage; in 1 eye, the hemorrhage expanded to the macula and postoperative visual acuity was compromised. Diplopia without apparent ocular motility restriction was noted in 7 eyes (5.1%); 3 of them underwent reoperation while the remaining 4 had either multiple or large and deeply located tears and therefore, a large buckle had to be sutured below the rectus muscle.

In 8 vitrectomy cases, iatrogenic breaks occurred (9.2%) but did not result in retinal redetachment. In 6 eyes (6.9%), the crystalline lens was traumatized; in 1 of these eyes, the lens had to be removed during the procedure to obtain an adequate view of the fundus. The postoperative corrected visual acuity dropped two lines or more due to postoperative nuclear cataract in 18 eyes (20.7%), all of which were in patients 55 years or older. In 2 eyes postoperative visual field defect occurred unrelated to the preoperative retinal detachment.

Epimacular membrane was noted postoperatively in 3 eyes (2.3%) of the scleral buckling group and in 2 eyes (2.2%) of the vitrectomy group (Table 2).

Table 2. Intra- and Postoperative Complications in Each Group*

Complication	Scleral Buckling	Vitrectomy
Subretinal hemorrhage	6 (4.3)	0
Penetrating suture	4 (2.9)	0
Lens trauma	0	6 (6.9)
Iatrogenic retinal break	0	8 (9.2)
Ocular motility problem	7 (5.1)	0
Epimacular membrane	3 (2.2)	2 (2.3)
Nuclear cataract	0	18 (20.7)
Visual field loss	0	2 (2.3)

*Values in parentheses are percentages.

Discussion

Scleral buckling is currently regarded by most vitreoretinal surgeons as the preferred method of treating most primary rhegmatogenous retinal detachments, and a single operation is successful in more than 90% of cases.[9] However, scleral buckling techniques are associated with various intra- or postoperative complications that may ultimately impair visual recovery. Vitrectomy offers certain advantages over scleral buckling in that it affords a direct approach to vitreous traction, which has been postulated in previous reports, especially in cases with large or deeply located tears.[1–6] In our hospital, the indication for vitrectomy has been expanded to include most of the cases of superior bullous detachment with flap tears.

Of the two typical types of retinal detachment, that seen in elderly patients generally accompanies posterior vitreous detachment (PVD); the degree of vitreo-retinal traction depends on the severity of posterior vitreous collapse. Vitrectomy, which directly releases the traction, is a reasonable method of treatment.

In contrast, retinal detachment caused by atrophic holes seen in younger patients typically does not accompany PVD. In these eyes in which tangential traction is present, removing the vitreous gel without inducing vitreous detachment will not only eliminate the traction but rather worsen the situation. Furthermore, attempting to induce PVD intraoperatively in younger patients often fails, and sometimes creates retinal breaks. Therefore, we believe that scleral buckling should be indicated in these patients. In determining the indication of scleral buckling or vitrectomy, it is essential to understand the difference between these two typical types of retinal detachments.

In this study, there was no difference in initial and final success rates between the two procedures, which were 92% and 100%, respectively. Oshima et

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al[10] conducted a similar study and included eyes with peripheral tears; our surgical results were similar to theirs.

In eyes with multiple tears, the initial reattachment rate was better in the vitrectomy group (28/29 [96.9%]) than in the scleral buckling group (16/23 [69.9%]). It is often difficult to accurately place the buckle for all multiple tears. Furthermore, in the case of deeply located or large tears, a large or deep buckle sometimes leads to disturbance in ocular motility. The present study has confirmed the advantages of vitrectomy in eyes with multiple, deeply located and large tears.

During vitrectomy, iatrogenic tears occurred in 8 eyes but did not affect the initial success rate. New retinal tear formation following vitrectomy generally occurs close to the sclerotomy, resulting from vitreous incarceration to the wound and vitreous contraction thereafter.[10] However, the new tears in our present study were identified at the posterior edge of the vitreous base, unrelated to the scleral wound. When eyes with lattice degeneration progress to retinal detachment, they sometimes have tears at a region that appears to be normal.[11] Clinical findings confirm that PVD often progresses peripherally after vitrectomy.[12] We, therefore, believe that the new tear formation noted in the eyes in our study resulted from the PVD progression into an apparently "normal" region but with strong vitreous adhesion. Another possible causative factor of new tears is insufficient vitrectomy accompanied by vitreous contraction due to gas tamponade; this suggests that thorough vitrectomy is necessary, not only around the tears and the scleral wound but all the way to the periphery in all quadrants.

When comparing eyes of the vitrectomy group with and without encircling scleral buckle, the initial success rate was 100% in the former and 86.3% in the latter group. During the early study period, we were using the encircling buckle in all patients based on the method described by Ogino[3]; this was discontinued in 1993. Of the three surgeons indicated previously, the most experienced achieved a 100% success rate without the placement of the encircling buckle; however, this rate was not achieved by the other two surgeons. This result indicates that the placement of an encircling buckle would be a safety precaution when vitrectomy is performed by less experienced surgeons.

The incidence of nuclear cataract following vitrectomy in patients older than 55 has been reported to be very high.[13,14] This is the major drawback of vitrectomy and, for this reason, more surgeons today are performing simultaneous cataract surgery in patients over a certain age even though he/she may have a relatively transparent crystalline lens. Because simultaneous cataract surgery simplifies peripheral vitrectomy and therefore decreases the risk of postoperative formation of new tears and redetachments, some surgeons perform cataract surgery even in young patients.[10,15,16] However, a nuclear cataract seldom progresses in young patients following vitrectomy,[13] as confirmed by the present study, and the loss of accommodation is a serious problem. Because we feel sufficient peripheral vitrectomy is possible by careful scleral indentation without having to remove the lens, we attempt to preserve the lens in most of the cases with a clear lens.

The most serious complication following retinal detachment surgery is PVR, which has been reported to occur in 8–20% of the cases undergoing vitrectomy and in 5–10% of the cases undergoing scleral buckling[2,17–23]; the reported difference is not remarkable (Table 3). In the present study, PVR was confirmed in none of the scleral buckling eyes but was detected in 3 (3.8%) of vitrectomy eyes. As already states above, while Oshima et al[7] reported initial and final success rates of 92% and 100%, respectively, none of the eyes in their study developed PVR.

The incidence of PVR is definitely affected by the type of eyes treated. For this study, eyes at a high risk of developing PVR had been excluded and the indication has been expanded to include eyes generally indicated for scleral buckling, all of which contributed to lowering the incidence of PVR. Although some surgeons are afraid that vitrectomy poses a risk of developing PVR, previous reports and the present study do not confirm the correlation between the incidence and the procedure. Moreover, the outcome of vitrectomy in the hands of an experienced surgeon with careful patient selection may not differ

Table 3. Reported Incidence (%) of Proliferative Vitreoretinopathy After Retinal Reattachment Surgery

Surgical Technique	Reference	%
Vitrectomy	Escoffery et al[2]	7
	Oshima et al.[10]	0
	Gartry et al[17]	9
	Hoeing et al[18]	19
	Heimann et al[19]	6
	Miki et al	3.8
Scleral buckling	Sharma et al[21]	6.15
	Girard et al[22]	10.5
	Michels et al[23]	5–10
	Miki et al	0

from that of scleral buckling. Finally, PVR was not detected in any eyes of the scleral buckling group, most likely because the study was retrospective and most eyes of multiple, large, or deeply located tears underwent vitrectomy instead of scleral buckling. We still should not, however, ignore the fact that PVR occurred in only the vitrectomy group.

Further studies are necessary to confirm which of the two procedures is superior. While a drastic change in the intraocular environment has been emphasized with vitrectomy, choroidal circulation disturbance does occur following scleral buckling[24] and a high incidence of macula edema after scleral buckling has been reported.[25] We have also experienced a case in which postscleral buckling visual acuity had dropped significantly in eyes with intact macula and good preoperative vision (unpublished data). On the other hand, diminished postoperative pain, unaffected ocular motility, and elimination of floaters are definite advantages of vitrectomy.[26]

Following vitrectomy, however, there is no longer a vitreous tamponade effect; if tears reopen by residual vitreous traction, eyes following vitrectomy are more likely to result in total detachment very early. Because retinal detachment and proliferative changes occur together, PVR may be immediately induced. Those eyes developing PVR after vitrectomy often need to undergo several reoperations and never quite recover complete visual function. In conducting vitrectomy, it is therefore important that the surgeon is able to readily perform reoperation(s) when redetachment is detected.

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