

# Twenty-Year Follow-up for Scleral Buckling

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**Objective:** To report 20-year follow-up data for patients receiving a scleral buckle for treatment of a primary rhegmatogenous retinal detachment (RRD).

**Methods:** Nonconsecutive, retrospective case series. We identified 227 eyes with primary RRD who were treated with a scleral buckle, and for whom at least 20 years of follow-up data were available. Results were classified into 3 subgroups: retina reattached with 1 procedure; retina reattached with 1 or more additional vitreoretinal procedures; or retina detached at 20 years.

**Results:** One hundred eighty-six eyes (82%) achieved retinal reattachment with 1 scleral buckling procedure and with a median final visual acuity of 20/40 at 20 years of follow-up. An additional 30 eyes (13%) achieved reti-

nal reattachment after 1 or more additional vitreoretinal procedures, with a median final visual acuity of 20/50. Eleven eyes (5%) were detached at the 20-year follow-up examination, with a final visual acuity in all eyes of no light perception.

**Conclusions:** Scleral buckling for primary RRD achieves anatomical efficacy and preservation of central vision in the majority of eyes at 20 years' follow-up. The 1-operation success rate was 82%, overall success rate was 95%, and median final visual acuity was 20/40. This study may serve as a basis for comparison with the long-term results of other surgical techniques used in the treatment of primary RRDs.

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**P**LACEMENT of a scleral buckle (SB) is the most established technique for the treatment of primary rhegmatogenous retinal detachment (RRD). Although Gonin<sup>1</sup> developed the principles of retinal reattachment in the early 20th century, modern scleral buckling procedures date to the 1950s and the work of Custodis,<sup>2</sup> Schepens et al,<sup>3</sup> and Arruga.<sup>4</sup> There is currently a wealth of information supporting the short-term efficacy of this procedure, but there is a relative paucity of long-term data. In a review of 7 articles reporting on 4940 eyes, Wilkinson and Rice<sup>5</sup> reported a 75% to 91% success rate with a single operation and an 88% to 97% success rate with multiple procedures. Wilkinson and Rice also reported that 39% to 56% of successfully treated eyes attained a visual acuity of 20/50 or better, although this percentage decreased to between 37% and 42% when only macula-off RRDs were considered. In both of these analyses, however, the length of follow-up was not discussed.

Tornquist and Tornquist<sup>6</sup> reported retinal reattachment at 10 years' follow-up in 442 (78%) of 566 eyes predominantly treated with encircling proce-

dures. Reoperations were required in 130 eyes (23%). Of successful cases, visual acuity was better than 0.5 (20/40) in 34%.

Kreissig et al<sup>7</sup> reported that 99 (94%) of 107 eyes treated with segmental buckling were attached after 11 years and that 13% of eyes required reoperation during this time frame. Of the 72 eyes available for follow-up at 15 years, mean visual acuity was 20/40.<sup>8</sup>

In this study, we report the outcomes of a retrospective, nonconsecutive series of 227 eyes treated with a scleral buckle for a primary RRD and for whom at least 20 years' follow-up data were available.

## RESULTS

Two hundred ten eyes (93%) were treated by cerclage, which in almost all cases consisted of an encircling element (a silicone rod or band) with an additional segmental sponge supporting the detached retina. The encircling element was a rod in 94 eyes (45%), a band in 83 eyes (40%), and could not be determined by our retrospective review in 33 eyes (16%).

In nearly all cases, cryopexy was the modality used for creating a chorioretinal adhesion during the initial scleral buck-

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## MATERIALS AND METHODS

The medical records at the McPherson Retina Center at Baylor College of Medicine (Houston, Tex) were reviewed. A total of 227 eyes from 212 patients met entry criteria for this study: primary RRD, treated with a scleral buckle by the McPherson Retina Associates, and for which 20 years of follow-up were available. In this retrospective, nonconsecutive study, no attempt was made to contact or otherwise retrieve the medical records of patients who were lost to follow-up during this period.

Eyes with proliferative vitreoretinopathy of grade C or greater, or with a history of scleral buckle, vitrectomy, posterior segment open-globe trauma, or significant concurrent eye disease (judged to independently compromise the postoperative visual acuity such as amblyopia, macular disease, etc) were excluded.

Eyes were subdivided into 4 groups: phakic macula-on RRDs; phakic macula-off RRDs; aphakic/pseudophakic macula-on RRDs; and aphakic/pseudophakic macula-off RRDs. The "macula-off" groups included those eyes in which the fovea was involved in the RRD. All macula-off RRDs were treated with encircling procedures. Some macula-on RRDs were treated with segmental procedures at the discretion of the treating ophthalmologist, and these data were independently recorded and analyzed.

Each eye was classified into 1 of 3 subgroups; retina reattached with one scleral buckling procedure ("primary" success); retina eventually reattached with additional vitreoretinal procedures ("eventual" success); or retina detached at the 20-year follow-up (failure). For the purposes of this report, we define "additional vitreoretinal procedures" as those procedures that were definitely necessary to achieve or maintain retinal reattachment. These

included revisions of the scleral buckle by repositioning the existing buckling elements or adding new ones (to treat a recurrent or persistent detachment) pars plana vitrectomy, drainage of choroidal detachment, and/or injection of temporary vitreous adjuncts (air or gas).

In contrast, for the purposes of this report, "additional vitreoretinal procedures" specifically excluded those procedures that were frequently performed during this period but that were not definitely necessary to achieve or maintain retinal reattachment. This included postoperative supplemental retinopexy (photocoagulation, xenon arc coagulation, or cryotherapy) and/or loosening or removal of the scleral buckling elements. A buckle loosening was performed by sectioning the encircling rod or band, typically as an outpatient procedure under local anesthesia. The buckling elements were otherwise left in position. Buckle loosening was performed either to ameliorate or to lessen the risk of transscleral (internal) erosion of the encircling elements at the discretion of the treating ophthalmologist, and in the majority of cases they were performed as preventative measures prior to any ophthalmoscopic evidence of erosion.

However, removal of the buckling elements involved explantation of some or all foreign material, including sutures. This procedure was typically performed to treat an established complication of scleral buckling surgery, such as infection, transconjunctival (external) extrusion, or ocular motility disturbances.

Preoperative and 20-year postoperative visual acuities were recorded. When refractions were not available, best-corrected visual acuities were used. Giant retinal tears were included in their appropriate group (phakic macula-on, etc), although this small subgroup of patients was also analyzed independently. Any additional procedures performed to the eye subsequent to the original scleral buckling operation were also recorded.

ling surgery. However, in a few operations performed during the early 1960s, diathermy was used; we estimate this percentage to be no greater than 3%, although we could not precisely determine this figure with our retrospective review. The summarized data for all groups of patients are presented in the **Table**.

A total of 227 eyes received treatment for a primary RRD. Of these, 210 eyes (93%) were initially treated with encircling elements. The median preoperative visual acuity was 20/100 (range, 20/15 to light perception). One hundred seventy-three eyes (83%) achieved retinal reattachment with 1 encircling procedure; the median 20-year visual acuity was 20/40 (range, 20/20 to light perception). Twenty-seven additional eyes (13%) achieved retinal reattachment after a median of 1 (range, 1-3) additional vitreoretinal procedure; the median 20-year visual acuity was 20/30 (range, 20/20 to light perception). Ten eyes (5%) never achieved retinal reattachment despite a median of 1 (range, 0-2) additional vitreoretinal procedure, and the 20-year visual acuity was no light perception in all of these eyes.

Seventeen eyes (7.5%) were initially treated with segmental elements. Of these, the median preoperative visual acuity was 20/25 (range, 20/15 to counting fingers). Thirteen of these eyes (77%) achieved retinal reattachment with 1 segmental procedure; the median 20-year visual acuity was 20/30 (range, 20/20-20/100). Three eyes

(18%) achieved retinal reattachment after 1 additional (encircling) vitreoretinal procedure; median 20-year visual acuity was 20/200 (range, 20/20-5/400). One eye (7%) never achieved retinal reattachment despite 3 additional vitreoretinal procedures, with a final visual acuity of no light perception.

Four eyes had giant retinal tears. No eyes achieved retinal reattachment with 1 scleral buckling procedure. One eye never achieved retinal reattachment despite 1 additional vitreoretinal procedure. The other 3 eyes achieved retinal reattachment after 1 additional vitreoretinal procedure, with a median 20-year visual acuity of 20/200 (range, 20/25 to counting fingers).

There were no important differences between the anatomical and visual outcomes when the data were analyzed according to lens status (phakic vs aphakic/pseudophakic) or macular status (attached vs detached).

Overall, 186 eyes (82%) achieved retinal reattachment with 1 scleral buckle procedure (encircling or segmental); the median 20-year visual acuity was 20/40 (range, 20/20 to light perception). Thirty additional eyes (13%) achieved retinal reattachment with a median of 1 (range, 1-3) vitreoretinal procedure; the median 20-year visual acuity was 20/50 (range, 20/20 to light perception). Eleven eyes (5%) never achieved retinal reattachment despite a median of 1 (range, 0-3) addi-

tional vitreoretinal procedures, and the 20-year visual acuity in all of these eyes was no light perception.

A total of 210 eyes (93%) received 1 or more supplemental treatments following the initial scleral buckle, with the most frequently employed modalities being adjunctive photocoagulation or xenon arc therapy in 124 eyes (55%) and cryotherapy in 28 eyes (12%). Additional procedures included loosening of the buckling element in 123 eyes (54%), revision of the scleral buckle in 37 eyes (16%), removal of the elements in 20 eyes (9%), and cataract extraction in 56 eyes (25%).

Of the 56 eyes that underwent subsequent cataract extraction, 3 (5%) developed recurrent retinal detachment. One was successfully repaired with 1 additional vitreoretinal procedure, and 20-year postoperative visual acuity was 20/20. The other 2 eyes remained detached at the 20-year follow-up examination despite 1 additional vitreoretinal procedure each. Visual acuity was no light perception in both.

Of the 210 eyes initially treated with cerclage, the buckling elements were loosened in 123 eyes (59%) and removed in 20 eyes (10%). Of the 123 eyes that underwent loosening, 53 (43%) showed ophthalmoscopic evidence of transcleral (internal) erosion at the time of loosening. Median visual acuity at 20 years' follow-up was 20/40 in the eyes that underwent loosening for erosion, 20/30 in eyes that underwent loosening without prior evidence of erosion, 20/40 in eyes that underwent removal of elements, and 20/40 in eyes that did not undergo loosening or removal.

No eyes developed a recurrent retinal detachment, vitreous hemorrhage, or endophthalmitis as a result of the loosening or removal procedures. One eye (0.8%) developed a choroidal detachment, which was successfully drained, and 1 eye (0.8%) developed orbital cellulitis, which was managed by removal of the buckling elements, along with local and systemic antibiotics.

## COMMENT

This report is limited to a specific subset of eyes with primary RRD that was without evidence of preexisting advanced proliferative vitreoretinopathy, treated with scleral buckling, and with 20 years of available follow-up data. Because of the specialized nature of this series, direct comparison with other reports is not possible, but certain comparisons may be made.

The aforementioned rates of retinal reattachment are consistent with previously published studies. Wilkinson and Rice<sup>5</sup> found that, in the short term, 75% to 91% of eyes were reattached with 1 procedure, and 88% to 97% were reattached with 1 or more reoperations. We report that, at 20 years' follow-up, 82% of eyes were reattached after 1 operation and 95% were reattached after multiple procedures. It was very rare for a recurrent retinal detachment to occur beyond 1 year following the initial procedure. The implication, then, is that a successful scleral buckle procedure tends to remain stable in the long-term. This finding is consistent with previously reported data. Tornquist and Tornquist,<sup>6</sup> with a follow-up of 10 years, reported a reoperation rate of 23%, while Kreissig et al,<sup>7</sup> with a follow-up of 11 years, reported a reoperation rate of 13%. In this study, the rate was 18%.

## Summarized Data for All Groups of Patients\*

Group	Primary	Eventual	Failure
Total			
Encircling (n = 210)	173 (83), 20/40	27 (13), 20/30	10 (5)
Segmental (n = 17)	13 (77), 20/30	3 (17), 20/200	1 (6)
Total (n = 227)	186 (82), 20/40	30 (13), 20/50	11 (5)
Phakic macula-on			
Encircling (n = 66)	57 (86), 20/30	8 (12), 20/25	1 (2)
Segmental (n = 14)	12 (86), 20/30	1 (7), 20/200	1 (7)
Total (n = 80)	69 (86), 20/30	9 (11), 20/30	2 (5)
Phakic macula-off			
Encircling (n = 87)	72 (83), 20/50	11 (13), 20/60	4 (5)
Aphakic macula-on			
Encircling (n = 26)	22 (85), 20/25	3 (12), 20/25	1 (4)
Segmental (n = 3)	1 (33), 20/20	2 (67), 20/80	0 (0)
Total (n = 29)	23 (80), 20/25	5 (17), 20/25	1 (3)
Aphakic macula-off			
Encircling (n = 31)	22 (71), 20/30	5 (16), 20/40	4 (13)

\*Data are presented as number of patients (percentage), visual acuity.

Regarding visual function, Wilkinson and Rice<sup>5</sup> reported that 39% to 56% of eyes achieved a visual acuity of 20/50 or better in the short-term. Kreissig et al<sup>8</sup> reported a mean visual acuity of 20/40 at 15 years' follow-up in successfully treated eyes; we present an identical median acuity at 20 years' follow-up. Our visual acuity data appear to be better than those of Tornquist and Tornquist,<sup>6</sup> who found that only 34% of successful cases had visual acuities better than 0.5 (20/40) at 10 years' follow-up. The conclusion, therefore, is that a scleral buckle offers long-term stabilization or improvement of central vision in the majority of eyes with primary RRD. The caveat, however, is that a significant proportion of eyes may require additional surgical procedures to maintain this acuity. For example, in our study, 56 eyes (50% of the phakic eyes and 25% of the total) required cataract extraction during the 20-year follow-up examination. This of course, is not unexpected, in view of the fact that these patients were elderly.

We did not find a substantial difference in anatomical nor visual outcomes if eyes were treated with segmental buckling rather than encircling elements. In our study, all macula-off RRDs were treated with an encircling element. While the majority of eyes with macula-on RRDs also received an encircling element, the percentage of primary successes in phakic macula-on RRDs was 86% in both groups, and the median 20-year postoperative visual acuity was likewise equal at 20/30 in both groups. Although the percentage of primary successes in aphakic macula-on RRDs treated with a segmental buckle was 33%, the sample size of 3 cases in this subgroup analysis is far too small to draw any valid conclusions. We therefore agree with the work of Kreissig et al<sup>7,8</sup> that, in carefully selected patients, segmental buckling procedures seem to be as efficacious as encircling procedures. We believe that our report, however, does provide support that the encircling technique can offer both anatomical and visual stability for the majority of eyes.

The 4 eyes with giant retinal tears had relatively poor outcomes compared with the results of the 223 eyes with smaller retinal breaks. Today, giant retinal tears would most likely undergo vitrectomy, with or without simul-

taneous scleral buckling. However, prior to 1980, vitrectomy was not widely used, and scleral buckling alone would likely have been considered the standard of care. Therefore, we have included these eyes in this report despite the relatively poor results.

A weakness of this study is its retrospective and, more importantly, nonconsecutive nature. These 227 eyes represent only those patients who were available for follow-up after 2 years, and no attempt was made to contact, or otherwise retrieve the medical records of patients who were lost to follow-up. Therefore, these 227 eyes comprise only a subset of all eyes undergoing scleral buckling during this period, and thus, they may or may not be representative of the total. It is possible that patients who have good surgical outcomes (anatomical and/or visual) are more likely to keep long-term follow-up appointments than patients with poor outcomes; therefore, these data may represent a "best-case" scenario. Nevertheless, we believe that these results are important because they illustrate the potential for long-term anatomical and visual successes from scleral buckling procedures.

An additional point of consideration is the relatively high percentage of eyes receiving postoperative supplemental retinopexy with photocoagulation (55%) or cryotherapy (12%) during the first several months following the initial surgery. This was a common practice of the McPherson Retina Associates during the 1960s and 1970s, but is performed only infrequently today. The treatment was applied to reinforce the original chorioretinal adhesion (generally cryopexy, but rarely diathermy), rather than in response to new postoperative retinal breaks or detachments. It is therefore not known what the effect would have been had this supplemental treatment not been administered.

Of interest, Kreissig et al<sup>7</sup> subdivided redetachment into early (occurring 2-4 months after surgery) and late (occurring 3-7 years after surgery). They found that early redetachments were due to proliferative vitreoretinopathy, and that late redetachments were due to formation of new retinal breaks. It is possible that postoperative supplemental retinopexy may have decreased the rate of redetachment in our series, as this problem was very rare. Of note, only 5% of all eyes undergoing subsequent cataract extraction during the 20-year follow-up period developed recurrent retinal detachment, indicating that in carefully selected eyes, cataract surgery following successful scleral buckling seems to be a fairly safe procedure.

However, the true effect of these supplemental, postoperative retinopexy treatments cannot be precisely determined. Therefore, these treatments were excluded from our definition of "additional vitreoretinal procedures."

A related point is the relatively high percentage of eyes undergoing loosening (54%) or removal (9%) of the buckling elements. The rationale for loosening of the scleral buckle was at least partly due to the fact that at least 94 eyes in this series received encircling silicone rods, which have since been abandoned because of their high rate of transcleral (internal) erosion. Similarly, almost all eyes undergoing encircling procedures received silicone rubber sponge explants. As compared with hard silicone ele-

ments (eg, tires), sponges have a higher rate of extrusion (external erosion),<sup>9-12</sup> though there is no definite evidence of a higher rate of transcleral (internal) erosion.

A mitigating factor is that of the 123 eyes treated with loosening of the encircling buckling element, 70 were loosened prior to any ophthalmoscopic evidence of transcleral (internal) erosion or any other complication. These preventative procedures, performed at the discretion of the treating ophthalmologist, involved sectioning of the encircling rod or band under local anesthesia and without removal of any buckling components. As noted previously, this technique was commonly performed by the McPherson Associates during the 1960s and 1970s, but is only rarely used today.

In contrast, removal of the elements involved explantation of some or all foreign material, including sutures, and this was typically performed to treat an established complication of the original scleral buckling surgery, such as a buckle infection, external extrusion, or ocular motility disturbance.

Long-term complications of encircling scleral buckling elements may include myopia, strabismus, transcleral (internal) erosion, and potentially, retinal and chorioidal ischemia. These risks may be higher in cases requiring a high buckle effect to reattach the retina (this was more frequent in the previtrectomy era) and in younger patients, in whom the elements will remain for many years. Loosening of the elements may prevent many of these complications. We were unable to demonstrate a significant difference in visual acuity between eyes that underwent loosening of the elements, removal of the elements, or neither. However, we believe that loosening of the encircling elements may provide a more stable long-term anatomic result. Additionally, when the buckle was loosened or removed, there appeared to be no significant increased risk of recurrent retinal detachment or other complications. Nevertheless, since the true effect of these procedures is unknown, they were excluded from our defined "additional vitreoretinal procedures."

Despite these considerations and potential limitations, this study represents the longest reported follow-up period for patients receiving a scleral buckle in the treatment of primary RRD. All patients were followed for at least 20 years, and with the total of 227 eyes, this represents 4540 "buckle years." This article documents the stability that can be achieved in the majority of patients receiving this type of treatment.

While surgical techniques are constantly evolving over the years and buckling materials are also changing, we believe that this article documents the anatomical and visual stability that can be achieved in this setting. The results of this study should serve as a useful comparison with future studies using alternative surgical techniques, including pneumatic retinopexy and/or pars plana vitrectomy surgery in the management of primary RRD.

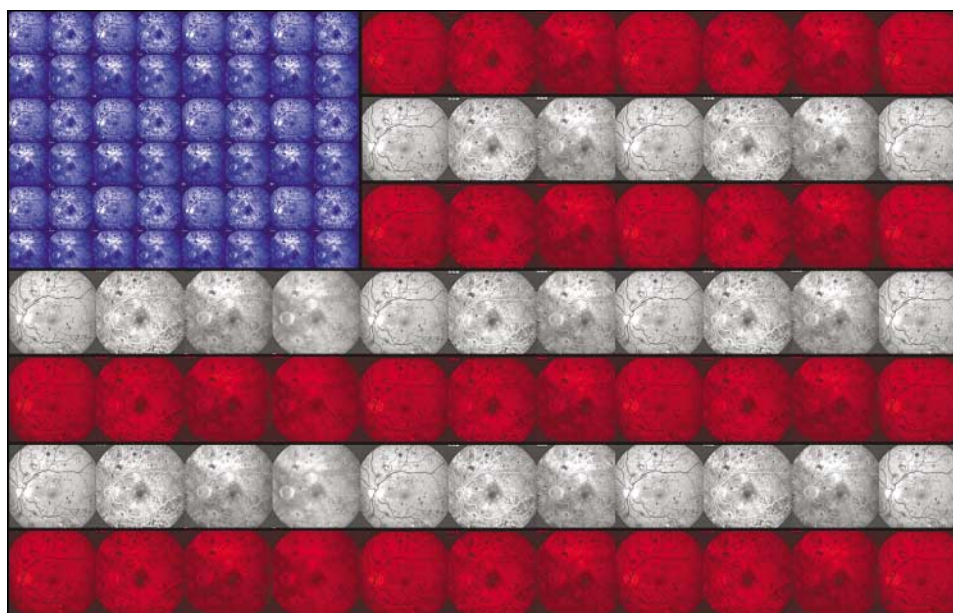
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**Fundus Flag.** Created by Patrick J. Saine, MEd, CRA, Dartmouth-Hitchcock Medical Center, Lebanon, NH.