

Prophylactic encirclement

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The basic requirements for successful prophylaxis of retinal detachment are first, the detection and accurate localization of all retinal breaks, and any lesions that may predispose to them; secondly, the counteraction of vitreous traction; and thirdly, the production of an adhesive chorio-retinitis in the correct location to achieve permanent sealing of all actual and potential retinal breaks. In addition, the chosen procedure should cause as little damage as possible to the eye and its adnexa.

There are several ways in which this may be achieved. In cases with no evidence of vitreous traction, such as those with degenerative round holes or tears with free opercula in the vitreous and no retinal elevation around the break, simple treatment with either cryopexy or photocoagulation is all that is necessary. However, when there is evidence of moderate vitreous traction, as with U-shaped tears with some evidence of retinal elevation along their edges, local indentation is indicated, in addition to the production of a chorio-retinitis.

Severe vitreous traction is signified by multiple U-shaped tears, which may occur in several quadrants, and it should be suspected if there are large areas of predisposing lesions, or a giant tear, in the fellow eye. In such cases, the creation of a permanent scleral buckle by encircling the globe should be considered.

Encircling operations have become established procedures in certain cases of retinal detachment, since the original description by Schepens (1957) and Arruga (1958), but their use as a prophylactic measure in eyes with flat retinæ has not previously been reported in the literature. Since August, 1968, the procedure has been carried out in this unit on eighteen carefully selected patients, and the purpose of this paper is to explain the rationale of this approach and to give the results of the patients treated so far.

Operative technique

Preoperatively the pupil is dilated with drops of atropine 1 per cent., and Genticin drops are instilled into the conjunctival sac every 2 hours to eliminate pathogenic organisms.

The operation is carried out under general anaesthesia, using fluothane, and as soon as the patient is anaesthetized an intravenous injection of Diamox 500 mg. is given to reduce the intraocular pressure, so that the encircling band may later be tightened without inducing an ocular hypertension (mannitol or urea may similarly be used).

A speculum is inserted, and the conjunctiva incised 6 mm. from the limbus right round the globe, and the sclera exposed; traction sutures are placed beneath the rectus muscles. All retinal breaks and degenerative areas in need of treatment are carefully localized using the indirect ophthalmoscope and their posterior limits are marked on the sclera, using either the cautery or a black suture. Before their position is re-checked by scleral indentation. These areas are then usually treated with cryopexy, although in Cases 11 and 17, no application was made at the time of surgery.

The eye is encircled with a silicone rod, or 2 mm. strap, so that the retinal pathology lies on the anterior slope of the resulting ridge. Mattress sutures of 5/0 braided terylene are placed in each quadrant in such a way that the encircling element can glide through the sutures and yet is prevented from slipping either forward or backwards.

The ideal depth of the ridge is about 1 mm. and this can be achieved by shortening the encircling element by 7 mm. (Hamilton and Taylor, 1972). The details are worth emphasizing.

The encircling element is initially drawn up to lie gently against the globe, but it is released to ensure that it is not under tension. Sutures are then placed around the two ends of the strap to mark the point at which they overlap, before the strap is tightened. The site of crossing is temporarily held with artery forceps, and the traction is released before the distance between the sutures is measured. This process is repeated until the distance between the marker sutures is 7 mm. when the strap may be secured. Alternatively a Watzke sleeve can be used. The optic disc must be observed periodically to ensure that the central retinal artery is not occluded.

The conjunctiva is closed with interrupted sutures of 6/0 catgut and the eye is padded. Postoperatively, drops of atropine 1 per cent. and Genticin are instilled once a day and a careful check is made daily for any signs of a rise in intraocular pressure. The patient is mobilized on the day after the operation and is discharged home a week later. The patient can return to work 3 weeks after surgery.

The operation is not without its potential hazards since, if the encircling element is drawn up too tightly, anterior segment necrosis, occlusion of the central retinal artery, and "strap pain" may be catastrophic consequences. But, provided the surgeon follows meticulously the technique described, these complications should not occur.

Results

Between April, 1968, and August, 1971, prophylactic encirclement was carried out on eighteen patients (14 males and 4 females). Fourteen eyes were myopic, of which seven had a correction of -5.75 D sph. or more, while two were aphakic and two were emmetropic. The patients varied in age from 25 to 69 years, and five of them gave a family history of retinal detachment.

Only one fellow eye was normal (Case 5). Of the remaining seventeen, thirteen had been previously treated for a detachment (four successfully but nine unsuccessfully), whilst four had received prophylactic treatment for retinal breaks.

Two patients (Cases 2 and 6) required postoperative photocoagulation to seal breaks which had not been covered by the encirclement, and two others (Cases 1 and 8) subsequently developed breaks behind the ridge which necessitated further treatment.

The fundus picture after operation in Cases 5, 12, 13, and 14 is shown in the colour plate (opposite); the appearance before operation is also shown for Case 12.

Complications were encountered in three patients: Case 11 developed a transient rise in intraocular pressure but no further sequelae, Case 6 developed a mild anterior segment necrosis causing a cataract, and Case 5 complained of slight diplopia due to a paresis of the inferior rectus.

After a follow-up period of 1 to 5 years, no detachment has developed in sixteen of the eighteen patients. In the two patients in whom the retina became detached (Cases 17 and 18), surgery was successful in Case 17 but failed in Case 18.

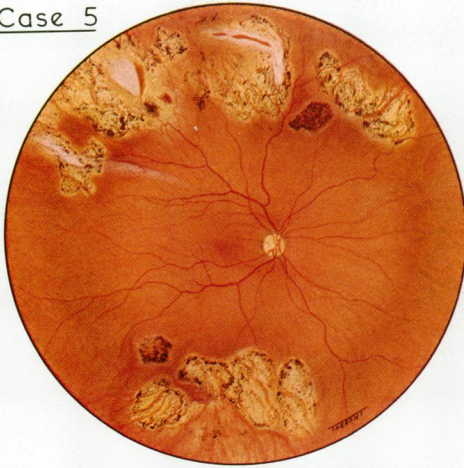
Full details of the eighteen patients are given in the Table, with diagrams of the treated eye before and after operation and also of the fellow eye.

Discussion

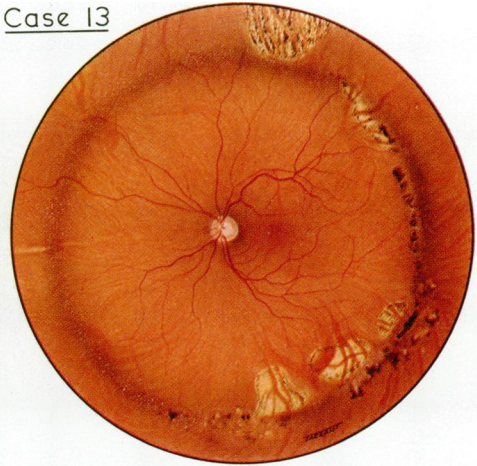
The decision whether or not to advise prophylaxis is often difficult, since the ideals of an entirely safe and yet effective procedure cannot be guaranteed, but faced with the reported

PROPHYLACTIC ENCIRCLEMENT

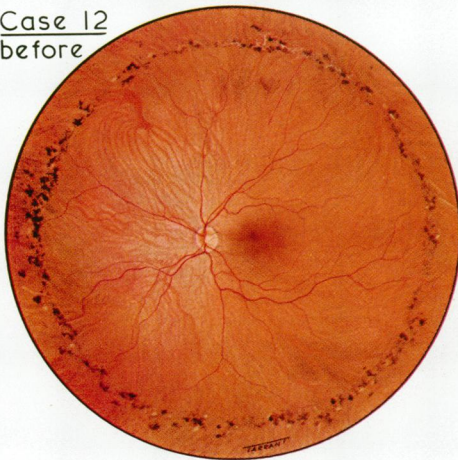
Case 5



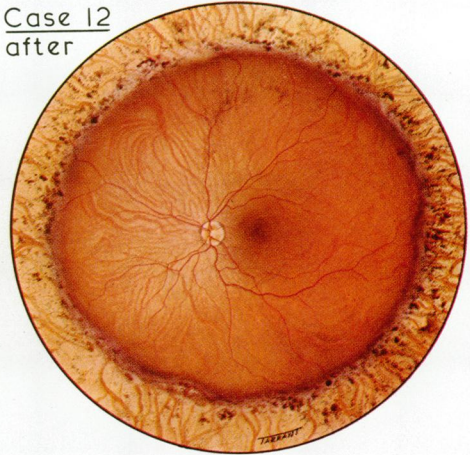
Case 13



Case 12
before



Case 12
after



Case 14

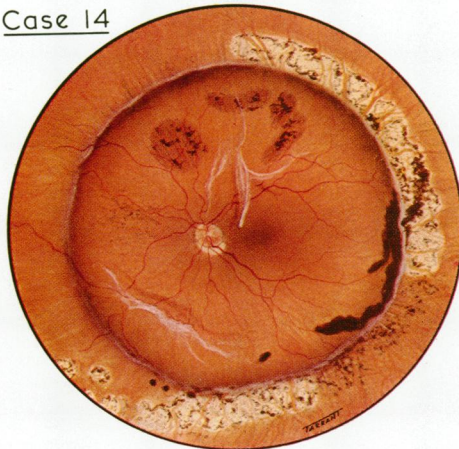


FIGURE *Fundus paintings of Cases 5, 13, and 14 after operation, and Case 12 before and after operation*

cases prophylactic encirclement seemed justifiable, even if this original approach proved controversial. The indications for the operation have yet to be exactly defined, but the findings in the eye at risk, the history and appearance of the fellow eye, and the family history will be decisive.

The essential merits of prophylactic encirclement are two-fold: First, a permanent circumferential buckle is achieved in the equatorial region which, by reducing the volume of the eye, helps to eliminate vitreous traction on existing or potential retinal breaks. Secondly, multiple breaks in different quadrants can commonly be sealed by this one manoeuvre. In addition, since a new ora serrata is created, a "barrage effect" is produced, so sealing off any breaks anterior to the buckle which may have been overlooked or inadequately sealed or which may have developed postoperatively.

The Table (overleaf) shows that Cases 1 to 7 had one or more large U-shaped tears and, in at least two other quadrants, lesions predisposing to retinal detachment, namely, retinal breaks or lattice degeneration in the presence of vitreous traction; Cases 8 to 18 had similar pathology in more than two quadrants. Consequently, all eyes were judged likely to develop detachment. This likelihood was enhanced when the eighteen fellow eyes were studied, since nine of them had had unsuccessful retinal detachment operations previously; four had had detachments but had been successfully treated; and a further four had been treated prophylactically for retinal breaks. Only one fellow eye was normal.

Five patients gave a family history of detachment and interestingly Cases 17 and 18 (who alone re-detached) were related and belonged to a family many of whose members suffer from vitreo-retinal degeneration.




























The great danger of encircling an eye prophylactically is that the encircling element may be drawn too tight, since there is no subretinal fluid to release to make the eye softer. This occurred in one patient (Case 6) operated upon early in the series but, if the minutiae of the technique are observed, this should not occur. Case 11 suffered a transient rise in tension for 48 hours, but this was easily controlled and no untoward sequelae developed.

Fortunately, the repeated applications of the cryoprobe can markedly reduce the ocular tension and, when many such applications are made, as in treating extensive areas of retinal pathology, the eye may prove conveniently soft and allow a satisfactory ridge to be achieved without any subsequent rise in pressure.

In no patient did complications arise during surgery. One patient (Case 5) subsequently complained of diplopia due to a paresis of the inferior rectus of the operated eye, but since he had binocular single vision in the primary position, no muscle surgery was undertaken.

Apart from Case 6, already referred to, only one patient (Case 14) had a lowered postoperative visual acuity. He was known to have had lens opacities before surgery and, since his visual acuity fell merely from 6/36 to 6/60 over a 2-year period, the deterioration was probably unrelated to the operation. Thus, a properly executed encirclement should have no adverse effect upon the patient's visual acuity.

Two patients (Cases 2 and 6) required further treatment because some of the original retinal breaks lay too far back to be sealed by the encirclement. It proved simple to apply photocoagulation to these areas later, and no new tears have developed. In contrast, fresh breaks developed behind the ridge in a further two patients (Cases 1 and 8) but again photocoagulation was successful in sealing them and in none of these four patients has a retinal detachment yet developed. Thus, in only two of the eighteen eyes treated, has a detachment occurred subsequently.

Case no.	Sex	Age (yrs)	Family history	PREOPERATIVE		OPERATION			OUTCOME		FOLLOW-UP		FELLOW-EYE	
				Visual acuity Refraction	Retina	First procedure	Complications	Second procedure	Retina	Visual acuity	UP (years)	Operation	Visual acuity Refraction	Retina
1	M	59	-	6/9 -3.5 D sph.		Encirclement 13 mm Cryo. 270° April, 1968		PC to two new breaks behind ridge Jan., 1969		6/9	5	PC to flat tear → RD → MVR	PL -5 D sph.	
2	F	58	-	6/9 plano		Encirclement 14 mm Cryo. Jan., 1970		PC to unprotected break at 1230°c Mar., 1970		6/9	1½	PC Cryo. → Flat	6/6 plano	
3	M	25	-	4/60 -19 D sph.		Encirclement 15 mm Cryo. Aug., 1971				4/60	1½	PC → Flat	6/6 -1 D sph.	
4	F	51	+	6/5 -7 D sph.		Encirclement 14 mm Cryo. Dec., 1970				6/6	2	PC Cryo. → Flat	6/6 -9 D sph.	
5	M	65	-	6/9 plano		Encirclement 14 mm Cryo. of 180° inadequate PC and cryo. Mar., 1969	Diplopia Paresis right inferior rectus No diplopia in primary position			6/9	1½	None	6/6 plano	
6	M	65	-	6/9 -5 D sph.		Encirclement 13 mm Cryo. Aug., 1969	Mild anterior segment necrosis	Cryo. → SD to unprotected tear at 10c behind ridge Nov., 69 → Aug., 70		1/60 Cataract	3	Encirclement PC → Flat	6/18 -4 D sph.	
7	M	69	-	6/6 +9 D sph. Aphakia		Encirclement 14 mm Plombage Cryo. Nov., 1969				6/9 Aphakia	2	Encirclement Aphakia → MVR	HM +9 D sph.	
8	F	55	-	6/12 -3 D sph.		Encirclement 14 mm Cryo. Nov., 1969		PC to <u>new</u> break behind ridge at 40c Mar., 1970		6/12	3	Encirclement → Total RD	HM -3 D sph.	
9	M	35	++	6/9 -65 D sph.		Encirclement 14 mm Cryo. Jan., 1969				6/9	3½	→ Giant tear Cataract	No PL	

10	M	25	+	Father	6/9 -3 D sph.		Encirclement 12 mm SD Cryo, 360° April, 1971				6/9	1 1/2	Encirclement → Flat	6/6 -4 D sph.	
11	M	67	-		6/6 -5 D sph.		Encirclement No applications Aug., 1969	Temporary rise in tension for two days	PC to areas of lattice Nov, 1969		6/6	2 1/2	Multiple operations → Total RD	HM	
12	M	52	-		6/12 -15 D sph.		Encirclement 12 mm Cryo. June, 1969				6/12	3	Encirclement PC → Flat Lens opaque	6/18 -14 D sph.	
13	M	45	-		6/5 -9 D sph.		Encirclement 13 mm Cryo. Nov, 1968	Lattice still present behind ridge			6/5	4 1/2	Encirclement Plombage → Flat	6/8 -8 D sph.	
14	M	49	-		6/36 -14 D sph. Lens opaque		Encirclement 15 mm Cryo. July, 1969				6/60 Lens opaque → Extr.	2 1/2	→ Old RD Glaucoma Enucleation		
15	F	56	-		6/12 Aphakia -9 D sph.		Encirclement 14 mm Cryo, 360° Aug., 1968				6/12 Aphakia	2	Cryo.	Aphakia (-9 D sph. preop.) 6/12	
16	M	61	-		HM Lens opaque -22 D sph.		Encirclement 15 mm Cryo. July, 1969		Lens extraction		6/24 Aphakia	3	Encirclement → Total RD	No PL -23 D sph.	
17	M	38	++	Mother ++ Brother	6/24 Lens opaque -4 D sph.		Encirclement No applications Oct., 1969	RD 6 months postop. because of new break Mar., 1970	Plombage Vitreal implant → Flat		3/60 Lens opaque	3	Encirclement Silicone injection → Total RD	No PL -3 D sph.	
18	M	32	++	Mother ++ Brother	6/9 -25 D sph.		Encirclement 15 mm Cryo. PC Aug., 1969	RD 10 months postop. → Giant tear	Plombage → Flat RD again Plombage Total RD		HM	1	Encirclement Plombage Silicone injection → MVR	HM -2 D sph.	

	Breaks		Lattice		Vitreous traction		Microcystoid		Thin retina 'atrophy'		Cryo. = Cryopexy		PC = Photocoagulation		RD = Retinal detachment		MVR = Massive vitreous retraction		PL = Perception of light		SD = Surface diathermy		HM = Hand movements
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Summary

Of eighteen carefully selected high-risk patients in whom the globe was encircled prophylactically, two subsequently detached.

The rationale, technique, and results of this new procedure are discussed.

Reference

HAMILTON, A. M., and TAYLOR, W. (1972) *Brit. J. Ophthalm.*, **56**, 695