Controlled encircling procedure for retinal detachment

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The encircling operation for the treatment of retinal detachment is a well established surgical method (Schepens, Okamura, Brockhurst, and Regan, 1960; Regan, Schepens, Okamura, Brockhurst, and McMeel, 1962; Girard and McPherson, 1962; Schepens, 1964; Brockhurst, 1965; Schepens, 1968). However, complications do occur and a number of these are related to the tightness of the encircling band. Where this produces an insufficient ridge, the indent may not be enough to close the hole. If the ridge is too great problems of anterior segment ischaemia (Schepens, Okamura, and Brockhurst, 1957; O'Day, Galbraith, Crock, and Cairns, 1966), strap pain, scleral necrosis (Okamura, 1965; Kurz and Ezrow, 1965), gross reduction of visual field, and meridional folds (Schepens, 1964; McDonald, 1965; Ferguson, 1965) can occur. In an attempt to reduce these complications a method was devised to produce a smooth even ridge of standard depth. A 2-mm. high indenting ridge was arbitrarily selected. The reduction in diameter of a sphere at the site of a 2-mm. indentation would be the initial diameter (D) less 4 mm. (Fig. 1).

The initial circumference of the sphere	$= \pi D$
The circumference at site of indentation	$= \pi (D-4)$
Therefore the difference in circumference	$= \pi D - \pi (D-4)$
	$= \pi 4$
	$= 12.5 \text{ mm.}$

$$\pi = 3.142$$

FIG. 1 Diameter reduction of an indented sphere

Therefore, if the encircling band is shortened by 12.5 mm., a 2 mm. high indenting ridge should ensue. To test the effectiveness of a controlled shortening of an encircling band fourteen cases of retinal detachment of widely varying types were treated.

Method

The encircling band is applied to the globe so that the retinal pathology will lie on the anterior slope of the indent. The band is secured in each quadrant by 5/0 braided terylene mattress sutures, so tied that the band is able to slide freely but not to slip forwards or backwards. The band is now drawn up without stretch and the site of the crossing marked with sutures (Fig. 2). This will give the initial circumference (πD).

FIG. 2 Marking initial circumference (πD) of globe

FIG. 3 Measuring shortening of strap

In some cases the shortening of the band can be achieved without release of subretinal fluid. If fluid is released a limited drainage only is done, just sufficient to allow for the shortening of the strap. If excessive fluid is released, the eye must be reconstituted. This is done by injecting, under direct observation, Ringer's solution or air, into the vitreous *via* the pars plana.

The band is now shortened and the site of crossing is temporarily fixed with artery forceps. The ends are relaxed and the distance between the sutures is measured until the separation of the sutures is 12.5 mm. (Fig. 3). The band is then secured.

In all but one case a 2 mm. silicone rubber strap and cryopexy was used. In this one case a doubled Arruga string was employed and no cryopexy was applied.

Results

Table I gives clinical details of the fourteen cases. Cases 1 to 10 were successfully treated with a single operation. Cases 1 to 8 had silicone strap, cryopexy, and drainage of subretinal fluid; Case 9 was similarly treated but no subretinal fluid was drained. In Case 10 a double Arruga string was used with drainage but no cryopexy. The results of these cases are given in Table II.

Cases 11 to 14 required further surgery. In Case 11 a hole developed anterior to the ridge 4 months after successful primary surgery and this was treated with plombage, cryopexy, and no drainage. In Case 12 a primary procedure of strap and cryotherapy

Table I *Clinical particulars of fourteen patients*

Case No.	Age (yrs)	Duration of retinal detachment	Retinal pathology	Vitreous pathology	Associated pathology	Extent of retinal detachment	Refractive error	Preoperative visual acuity
1	87	2 wks	No hole found	Nil	Cataract	Total	+ 2.00	Counting fingers
2	57	2 mths	Multiple round holes	Nil	Nil	Lower $\frac{1}{2}$	- 3.50	Counting fingers
3	23	3 mths	Chorio-retinal scarring	Extensive vitreous traction	Aphakic	Total	+ 12.00	Hand movements
4	34	3 days	Multiple round holes	Nil	Previous temporal half scleral resection	2/3	- 14.00	6/18
5	10	3 mths	Dialysis	Nil	Nil	Inferior $\frac{1}{2}$	- 1.00	6/24
6	42	2 wks	Macular hole	Nil	Nil	Total	- 1.50	Hand movements
7	54	2 days	Multiple round holes	Nil	Nil	Upper $\frac{1}{2}$	+ 5.00	6/36
8	31	1 wk	Multiple round holes and lattice	Nil	Nil	3/4	- 18.00	Counting fingers
9	71	4 days	Two holes and lattice	Nil	Aphakic	Total	- 13.00	Hand movements
10	53	2 mths	No hole visible	Extensive exudative haze	Aphakic with anterior chamber implant uveitis	Total	+ 15.00	Perception of light
11	65	2 mths	Multiple round holes and lattice	Nil	Nil	Sub-total	- 8.50	Hand movements
12	48	2 yrs	Multiple round holes and lattice	Nil	Nil	Temporal $\frac{1}{3}$	- 1.75	Counting fingers
13	75	3 wks	No holes found	Nil	Nil	Nasal $\frac{1}{4}$	- 10.00	6/18
14	72	1 wk	Multiple holes	Nil	Aphakic	2/3	+ 12.00	Hand movements

Table II *Results in ten cases successfully treated*

Case No.	State of retina	Present visual acuity	Time of follow-up (mths)
1	Flat	6/60	8
2	Flat	6/60	5
3	Flat	6/18	5
4	Flat	6/18	4
5	Flat	6/24	3
6	Flat	Counting fingers	3
7	Flat	6/9	4
8	Flat	Counting fingers	3
9	Flat	6/12	7
10	Flat	6/18	6

with no drainage was unsuccessful; 1 month later a silicone gutter was placed under the strap in one quadrant and subretinal fluid drained with application of further cryopexy. Case 13, in which no hole was found, was unsuccessfully treated with cryopexy, strap, and drainage; further surgery was refused. Case 14, an aphakic, was unsuccessfully

treated with the initial encirclement and a gutter was placed under the strap at the site of a leaking hole. After this the retina flattened, but 3 months later massive vitreous retraction developed. The results of Cases 11-14 are summarized in Table III.

Table III *Results in four cases requiring additional surgery*

<i>Case No.</i>	<i>State of retina</i>	<i>Present visual acuity</i>	<i>Duration of follow-up (mths)</i>
11	Flat	6/36	6
12	Flat	Counting fingers	3
13	Total detachment	Hand movements	
14	Total detachment with massive vitreous retraction	Perception of light

FIG. 4 *Postoperative painting of Case 2*

FIG. 5 *Postoperative painting of Case 6*

FIG. 6 *Postoperative painting of Case 8*

Using the method we have produced a gentle ridge in all the cases as shown by the post-operative paintings in a selection (Figs 4, 5, 6). Flat retinæ have been achieved in all but two. No other complication occurred and in particular we observed no sign of anterior segment ischaemia, no patient complained of strap pain, and meridional retinal folds were not produced.

Discussion

The difficulty frequently arises as to how much a strap should be shortened (Girard, 1965); this led us to the adoption of the present technique. The temptation to overtighten the strap is always present. This is especially so in a soft eye when the appearance of the indent at the time of surgery is misleading.

Our present indications for the procedure are multiple pathology, aphakic detachment, retinal dialysis, macular hole, vitreous traction, and cases in which no hole is found. In patients with extensive vitreous traction, a more severe indentation may be required. However, in the one case of traumatic vitreous traction, a controlled encirclement was successful.

Whether we should extend this procedure to all cases of retinal detachment is debatable. It is usually necessary to drain subretinal fluid even with a controlled encirclement. This can often be avoided with local plombage. However, local plombage does have some disadvantages; a single area of retina treated and the indent is often of a temporary nature. A 360° indent remains permanently and may protect against subsequent detachment (Urrets-Zavalía, 1968).

Conclusion

The method described gives a smooth even ridge sufficient to serve the purpose for which it was designed without excessive distortion of the globe. We therefore hope that the encircling operation has been converted from an art to a science.

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