

**MODIFICATIONS FOR THE OBLIQUE ENCIRCLING
SILASTIC 3 MM BAND WITHOUT EVACUATION
OF SUBRETINAL FLUID (MORTADA OPERATION)
FOR GIANT RETINAL TEARS**

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The oblique encircling silastic 3 mm. band without evacuation of subretinal fluid (Mortada 1, 2), for giant tears extending behind the equator of the globe has a very high percentage of success so long the encircling band effect is seen in the fundus a bit behind the posterior edge of the retinal tear. It is curious that appearance of all the encircling band effect in the fundus means that the choroid in all the area in front of the buckle is in contact with the retina and retinal tears edges but this contact is not sure in the area behind the buckle.

So recurrence usually occurs if:

1. The band pressing effect is not seen in the fundus behind the tear denoting insufficient buckling as in case of thick sclera opposite the tear, especially with severe vitreo retinal traction.
2. Or the band effect is seen in the fundus anterior to the posterior edge of the tear as in case of a tear extending much posteriorly to near the optic disc edge.

The aims of the present study are:

- I. To find modification for the oblique encircling band without evacuation of subretinal fluid if

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1. Sclera opposite the giant tear is thick (about 30% of cases) preventing proper buckling.
2. The tear extends posteriorly to near the optic nerve (very rare) with surgical difficulty in fixing the band by sutures to the sclera posterior to the tear as in case of giant retinodialysis with inrolled edge, reaching to about 6 mm. from the optic disc edge.

II. And to know:

1. The proper position of encircling band in relation to the tears.
2. Does additional segmental radial or circumferential silastic 5 mm. rod opposite the tear area has any more buckling effect than that of the band alone?
3. How does subretinal fluid without its evacuation quickly absorb after the operation?
4. Management of factors causing non appearance of fundus buckling effect.
5. Can evacuation of subretinal fluid or accidental fluid vitreous loss followed by severe hypotony, give more buckling effect?
6. The role of jelly vitreous counter-pressure in success of the operation.
7. Danger of application of encircling band in cases of proliferation diabetic traction detachment.
8. Management of accidental loss of subretinal fluid or fluid vitreous.
9. Unavoidable causes of failure of the operation.
10. The cheapest way to prepare the silastic 3 mm. band, and effect of same band tightness on ocular tension.

Case report

In following retinal detachment cases with giant tears, extreme care was taken in observing the factors affecting the degree of oblique encircling band tightness (Mortada, 3), as ocular tension before and after the operation (Mortada 4), to prevent any choroidopathy complications (Mortada, 5, 6, 7), and to prevent band tightness on the softened sclera.

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Examples and general principles for operate cases are as follows:

1) General position of the buckle in relation to the edges and operculum of a giant horse-shoe tear.

The degree of vitreous traction on operculum of a horse-shoe tear and size of tear shows the degree vitreous traction on retinal tear edges. The edge of operculum is more pulled inwards and forwards by vitreous traction (Fig. 1: A). Buckling at anterior part (Fig. 1: B), or middle of the tear (Fig. 1: C), does not close the tear but segmental circumferential buckling just posterior to the tear pushes more the tear edge inwards and forwards towards the operculum edge and bring all tear edges in contact with the choroid with success of the operation (Fig. 1: D). All the tear must lie comfortably on the anterior slope of the buckle.

2) Position of band encircling buckle in case of a pre-equatorial giant tear.

The equatorial encircling band is all that is needed for a pre-equatorial giant tear. During the operation (Figs. 2: A, B, D), the tear may be seen open, but next day as the fundus encircling band effect is seen especially in area behind the tear, the tear is closed and is not seen (Fig. 2: C), with success of the operation.

3) Position and fundus appearance of the oblique encircling silastic band in relation to giant horse-shoe tear extending posterior to the equator of the globe.

- I. Position: The band must pass a bit posterior to the posterior edge of the tear.
- II. Fundus appearance: The encircling band effect must appear all around especially in area posterior to the tear otherwise the tear will not permanently close with recurrence of retinal detachment.

I. Position of the oblique encircling band:

- A. The encircling band must be placed posterior to the tear Fig. 3 (1: a, b & c) and Figs. 4 & 5 (C: 1 & 2) putting the choroid in contact with tear edges, thus success of operation.

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- B. If the encircling band is placed anterior to the posterior edge of the tear, the part of the tear, anterior to the encircling band is closed and not seen but the part posterior to the band is left open Fig. 3 (II: a, b & c) and Figs. 4 & 5 (A & B: 1 & 2) with recurrence of retinal detachment.

II. Two factors affect non appearance of encircling band fundus effect in the area behind the tear, even if it was properly placed:

- A. The band was not pressing sufficiently on the sclera. The maximum allowed pressure in cases operate for the first time is only about 25 mm Hg. (Schiotz above the preoperative level otherwise pressure uveopathy complications may arise (Mortada, 5, 6, 7).
- B. Thick sclera opposite tear area occurs usually in about 30% of giant tear cases. The lower half of sclera is generally thicker than the upper half.

If the band fundus effect is not seen in early post operative days in area posterior to the tear, (Fig. 6: A) the tear usually opens again with recurrence of detachment (Fig. 6: B).

4) Surgery for recurrent retinal detachment due thick sclera opposite giant horse-shoe tear preventing proper buckling.

As the eye was pressed before by an encircling band, in recurrent operation the eye may not tolerate another pressing elastic cerclage without reacting by severe uveopathy. The effects of the previous operation are still present: the very low ocular tension, the soft sclera, and choroidopathy especially opposite tear area making easy rebuckling by a circumferential segmental 5 mm. silastic or silicone rod placed just behind the tear area on the previous band site (Fig. 6: c). The segmental buckling effect is then seen in the fundus continuous with the previous encircling effect (Fig. 6: D), that is the buckling circlage effect is seen behind the tear with success of the operation.

5) Modifications for oblique encircling silastic 3 mm. band without evacuation of subretinal fluid in case of thick sclera opposite retinal tear area.

A thin sclera is known by its bluish colour and that during operation few minutes after the band pressure effect, the pressed scleral area appears

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more blue (Mortada sign), due to engorgement of underlying choroidal vessels. A thin sclera makes no problems for effective proper buckling.

If during the operation the surgeon finds that the sclera in area of and posterior to the tear is thick preventing producing an effective buckling of the tear area; the following two modifications are effective:

- I. Buckling at two pressure levels.
- II. Half scleral thickness incisions along the anterior and posterior edges of the band in an area wider than the tear meridians.

I) Modification I: Buckling at two pressure levels.

Suppose there is a giant horse-shoe tear up and out extending a bit behind the equator of the globe and that the preoperative ocular tension was 5 mm Hg. (Schiotz).

The encircling band is passed under the four recti muscles near their insertions to the sclera. Down and out the 2 free ends of the band are pulled and tied while the band is pressing the globe, so that the ocular tension is 40 mm Hg. (Schiotz). The band is fixed to sclera by a suture at position one (Fig. 7: A), down and in opposite the tear area at level with insertion of recti muscles. Suture one is temporary and is only meant to prevent slipping backwards of the cerclage. The band is pushed backwards up and out and is fixed by a mattress supramid suture to sclera posterior to the tear (suture two). Also at 3 and 4 the band is fixed to the sclera at a level posterior to the tear by sutures. So the band between fixed sutures 3 and 4 in area behind the tear is pressing the sclera at ocular pressure of 40 mm Hg. (Schiotz).

Suture one and the tie at band ends are untied and the band ends retied while the band is pressing to raise the ocular tension only to 25 mm Hg. (Schiotz). Suture one is retied again. Additional sutures are placed to fix the band to the sclera at positions 5 and 6. Ends of the band beyond the knot are cut. The sclera around the tear is cauterized by minimal diathermy or cryocautery but never to evacuate the subretinal fluid. So there is now encircling buckling effect at two pressure levels, one behind the tear area at level of 40 mm Hg. and otherwise at level of 25 mm Hg. (Schiotz) (Fig. 7: B).

II) Modification II. Half scleral thickness incisions.

At end of usual operation of oblique encircling silastic 3 mm band without evacuation of subretinal fluid raising the ocular tension 25 mm Hg. (Schiotz) above the preoperative level half scleral thickness incisions are performed at anterior and posterior borders of the band behind the tear in an area wider than tear meridians (Fig. 7: C), to weaken the sclera in the area behind the tear and so better buckling effect.

Both modifications I and II, can be combined (Fig. 7: D), aiming at better buckling of the tear at a lower band pressure.

III) Modification III. Pushing the band on side of the tear backwards by the little finger.

For giant tears extending to about 6 mm. from edge of optic disc, on side of the tear, the oblique encircling band is pushed by little finger to come in contact with the optic nerve, the band being fixed to the sclera by suture in meridian opposite the tear at level of a rectus insertion.

Another example for importance of position of the oblique encircling band and that its effect must appear in the fundus a bit behind the posterior edge of the tear is the giant retinodialysis with inrolled edge reaching to about 6 mm. from optic disc (Fig. 8: A and B), extending from 6 to about 12 o'clock meridians on one side.

Diagram (Fig. 9: A & B), shows the temporal giant retinodialysis and the fundus picture effect of oblique encircling band when:

i) (Fig. 9: 1), on side of retinodialysis the oblique encircling band is sutured to the sclera as far back as the surgeon can put sutures from 6 to 12 o'clock. The band is crossing over the insertion of inferior oblique muscle and still the fundus effect is a buckle anterior to the rolled edge of the retina with failure of operation.

ii) (Fig. 9: 2) The oblique encircling band is pushed on temporal side by little finger to remain in contact with the optic nerve and so is fixed at that site from 6 to 12 o'clock meridian, nasally by optic nerve and temporally by the bulging posterior staphyloma or larger curvature of the globe. The fundus picture shows the oblique encircling band effect passing behind the rolled edge of dialysed retina forming a new ora with success of the operation.

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If the encircling buckling effect is not seen behind all the retinodialysis edge, recurrence occur and in that case reoperation is performed with same modification number three technique. Reoperation usually succeed in showing the encircling buckling effect behind all the retinodialysis edge as the previous operation produced very low ocular tension, and soft sclera in pressed area facilitating the rebuckling effect of the band.

If operation or reoperation succeeds in performing a new ora, still the presence of vitreous in contact with a large surface of the exposed choroid (without retina in between, in area of giant retinodialysis) irritates the uveal tract and in about two months uveopathy usually occurs with loss of vision.

6) Can additional radial or circumferential segmental 5 mm. silastic rod buckling has any more buckling effect on a giant horse-shoe tear if added to the encircling silastic 3 mm. band without evacuation of subretinal fluid?

I) Meridional (radial) segmental buckle opposite the tear area may not close the tear (Fig. 10: A), and if it is placed under the effect of the encircling band it may abolish the band buckling effect of pusing the choroid to be in contact of edges of the tear (Fig. 10: B).

II) Simple circumferential segmental buckle pressing just posterior to the tear places the tear edges in contact with the choroid (Fig. 10: C and Fig. 12: 1); but the temporary buckle may recede with reopening of the tear (Fig. 12: 2).

III) Circumferential segmental buckle has no more permanent buckling effect when placed anterior (Fig. 11: C), or posterior (Fig. 11: D), to the encircling band. In early post operative days the band is still active by its elastic nature and with post operative drop of ocular tension the segmental circumferential buckle recedes and loses its buckling effect. Also a segmental buckle underneath the band effect (Fig. 11: B), has no more buckling power than the band itself alone.

IV) The best buckle is that of the oblique encircling silastic band alone passing a bit behind the posterior edge of the tear without evacuation of subretinal fluid, bringing a permanent contac of choroid tear edges (Fig. 10: D and Fig. 11: A).

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TABLE SHOWING

Percentage of success of oblique encircling silastic 3 mm band without evacuation of subretinal fluid, without and with modifications in cases with giant¹ retinal tears:

<i>Size shape and position of tear</i>	<i>Thickness of sclera</i>	<i>Added modifications</i>	<i>N^o of cases</i>	<i>Percentage of success</i>
I. One quarter of globe circumference, hose-shoe, extending up to about 6 mm. posterior to equator	1. Thin	Nothing	30	90%
	2. Moderate & thick	Nothing	10	70%
	3. Thick	1 ² + II ²	20	90%
	3. Moderate	Additional to band: 2 radial segmental ³ opposite tear	6	50%
	4. Moderate	Additional circumferential segmental: I. anterior to band II. posterior to band	10	80%
			10	90%
II. Retinodialysis from 6 to 12 meridians on one side dialysis edge 6 mm. from optic disc.	Moderate	1. Nothing	5	0%
		2. III ²	5	40% for ⁴ 2 months

N. B.: ¹ A retinal tear is considered giant when it extends more than one quarter of circumference of the globe.

² See case report for modifications I, II & III.

³ Segmental buckling is performed by silastic 5 mm rod.

⁴ Contact of vitreous to exposed choroid caused uveopathy and loss of vision.

DISCUSSION

1) Value of encircling silastic 3 mm. band without evacuation of subretinal fluid in retinal detachment surgery:

I. Scleral buckling of retinal tear by synthetic material gives the highest percentage of success than any other retinal detachment operation.

II. Encircling silastic 3 mm band operation giving permanent buckling gives higher percentage of success than segmental silastic 5 mm rod temporary buckling that may recede.

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III. Non-evacuation of subretinal fluid gives higher percentage of success for the detachment operation than the evacuation technique if scleral buckling is performed by synthetic material.

2) The importance of a permanent properly placed of sufficient height buckling of retinal tear in success of retinal detachment operation:

It is noticed from the following example that:

I. Post operative recession of a properly placed segmental buckle as by giving way of scleral sutures (over the rod) is followed by reopening of the tear and recurrence of retinal detachment. (Fig. 12: 1 & 2).

II. In case of an encircling band placed properly by sutures to sclera to pass behind the tear but the encircling band effect was not seen in the fundus especially in the area behind the tear because of thick sclera or insufficient buckling pressure the tear reopens with recurrence of retinal detachment.

III. Experience showed that if the buckling band is placed posterior to the tear, the tear is closed but if placed anterior or opposite its middle, the tear is not closed totally. The encircling band placed behind the tear must have raised the choroid in front of the band to come in contact with all the tear edges but not to raise the choroid posterior to the band to the tear edges level. This must have a mathematical explanation.

3) How can the surgeon know that the encircling silastic band without evacuation of subretinal fluid is buckling the tear area properly?

The answer is that by seeing in the fundus the band buckling effect a bit posterior to the tear or tears area.

4) Can additional evacuation of subretinal fluid or accidental vitreous loss followed by hypotony have any more buckling effect on retinal tear by the silastic segmental rod or encircling band?

Pre-operative bed rest with the tear most dependant helps absorption of subretinal fluid and shows the degree of vitreoretinal traction detachment. The fundus picture of retinal detachment may be due to subretinal fluid or vitreous retinal traction detachment without subretinal fluid.

Attempts to evacuate the subretinal fluid opposite the most detached retinal area may result in:

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- A) When only the choroid is perforate.
 - I. Evacuation of real subretinal fluid.
 - II. No fluid comes out in cases of traction detachment.

- B) When the choroid is thin and there is also accidental wrong perforation of retina the result depends on condition of the vitreous.
 - I. If the vitreous is gelly, nothing comes out or only prolapse of a gelly bead of vitreous.
 - II. If the vitreous is fluid, it escapes.

Evacuation of subretinal fluid or fluid vitreous may reduce markedly the ocular tension and may lead to: (Fig. 12: 4).

- I. Corrugations of sclera, choroid and retina.
- II. Prevention of vitreous counter pressure on lips and operculum of the tear, to come in contact with the choroid.
- III. No appearance of buckling effect in fundus in case of thick sclera.
- IV. Absent buckling pressure to produce in pressed area:
 - a) Retino-choroidopathy that aids in sealing of the tear and drop of ocular tensión for better buckling.
 - b) Scleral softening to give more buckling effect.
 - c) Quick absorption of subretinal fluid.

After evacuation of subretinal fluid if the buckling pressure is increased the ocular tension may not rise to the proper level and the catastrophe is that, if fluid vitreous is lost severe hypotony of the globe may occur.

- 5) Management of accidental loss of subretinal fluid or fluid vitreous.

After passing the band under the 4 recti insertions, the band ends are pulled and tied so that ocular tension is about 25 mm Hg. above the preoperative level. If during fixation of the band to sclera by sutures there is accidental subretinal fluid loss due to passage of needle in thin sclera,

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and choroid with drop in ocular tension, the band must be fixed to its previously designed place (without any trial to pull on again the band ends that may not raise more the ocular tension). The scleral perforation is cauterized by diathermy. In early post operative days as the scleral perforation closes, the encircling band effect usually appears in the fundus.

6) How subretinal fluid is quickly absorbed after scleral buckling by synthetic material without evacuation of subretinal fluid (Mortada hypothesis).

Gass (8) suggested that the pigment epithelial cells have a physiologic "pump mechanism" that maintain the retina in a relative state of deturgescence and help in absorption of subretinal fluid after closure of the retinal tear by segmental scleral buckling without evacuation of subretinal fluid (Custodis, 9).

Mortada hypothesis is as follows: The pressing buckle:

- I. Closes the retinal tear.
 - II. Induces retino-choroidopathy that gives rise to:
 - a. Migration of many pigment epithelial cells towards the pars optica retina (Mortada, 6), making defects in this barrier layer.
 - b. Defects in elastic Bruch's membrane giving fissures through which subretinal fluid passes towards choroidal draining vessels.
- 7) Trials to solve problems in treating giant retinodialysis with inrolled edge.

The recent ideas in treating giant retinodialysis as from 6 to 12 o'clock meridians on one side with inrolled edge reaching to about 6 mm. from the edge of optic disc are as follows:

- 1: To unroll the edge and unfold the affected retina.
- 2: To regain the normal chorioretinal position by incarceration of retinal edge in sclero-choroidal wounds every 30 degrees.
- 3: And then to perform a buckling operation.

Our trials by head positioning and intravitreal air injection did not succeed in unrolling the dialysed retinal edge. Trials to incarcerate retinal

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edge in sclerochoroidal wound assisted by aspiration of detached edge of retina by needle tip, application of cryoprobe to the margin of inverted retina or aspiration of formed vitreous near the torn edge of retina into a blunt needle were not successful in replacing the retinal edge to ora serrata normal position but gave more injury to the retina with vitreous loss leading to severe hypotony, severe uveitis and loss of vision. Lamellar scleral resection and segmental silastic rod buckling were also failures. These case have bad prognosis because:

I. The dialysed retinal periphery is not only inrolled but also contracted, retracted, and pulled backwards by vitreous traction (Fig. 8: B).

II. The oblique encircling band must be placed behind the edge of the separated retinal edge that is far backwards even in contact with the optic nerve.

III. Vitreous is usually filling the subretinal space preventing proper buckling (Fig. 8: B).

IV. The exposed large surface of choroid with its adherent pigment epithelial cells is irritated by its abnormal contact with vitreous giving choroiditis, severe uveopathy and loss of vision. The big area of detached retina also gives irritation and uveopathy.

8) Importance of presence of gelly vitreous counter pressure o success of buckling operations by synthetic material.

A gelly vitreous counter presses on the edges of the retinal tear against the pressed choroid by the synthetic buckling material and thus vitreous counter pressure is important for closure of the tear (Fig. 12: 1). If vitreous is fluid, its counter pressure action may be absent. In early few post operative days the encircling band presses some fluid out of the eye and thus it acts against no vitreous counter pressure. The fundus encircling buckling effect gets smaller and smaller and then corrugated with bad buckling effect and may be recurrence of retinal detachment. The recurrence here is due to a diseased fluid vitreous giving a similar picture to that of accidental fluid vitreous loss (Fig. 12: 4). Saline or air injection in vitreous to keep vitreous counter pressure is not of much help as they absorb quickly.

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9) Dangers of application of the encircling band in cases of proliferative diabetic retinopathy with retino and papillo-vitreous neovascularisation and traction retinal detachment.

1: In these cases there is no subretinal fluid, retinal detachment is due to increased vitreo retinal traction.

2: If the encircling silastic band operation is performed, the retino choroidopathy produced may intensify the already present retinopathy.

3: Photocoagulation by Argon Lazer or Xenon-arc is also contra-indicated (10).

1) Unavoidable causes of failure of scleral buckling by silastic 3 mm encircling band at proper buckling pressure without evacuation of subretinal fluid are:

1: Lack of sufficient vitreous counter pressure as in some cases of extremely fluid diseased vitreous, or severe vitreous retraction with severe retinal traction.

2: Very sensitive choroid even to needed moderate buckling pressure reacting by severe uveopathy. Probably in these cases there is a pre-operative mild choroidopathy which is accentuated by pressure of the synthetic material.

These two factors account for the two to three percent failures of the operation.

11) The cheapest way to prepare the silastic 3 mm band is as follows:

By a fine tipped sharp scissors the 8 cm. long silastic 5 mm. rod is equally bisected longitudinally. Each half is bisected and each quarter is again equally bisected longitudinally. This forms 8 band each of 8 cm. long and 3 mm. breadth. From each band the spongy inner surface is removed to give an elastic smooth, very soft, thin band for use in Mortada operation. The band is sterilized by immersion in chloramphenicol 1% aqueous solution for 2 hours before the operation. After application of the encircling band, the immediate post-operative ocular tension must be regulated by tonometry, as for different eyes the same band tightness gives variant ocular tension readings.

SUMMARY

Three new modifications are added to the oblique encircling silastic 3 mm. band without evacuation of subretinal fluid (Mortada operation) for giant retinal tears extending behind the equator of the globe.

- 1: In case of thick sclera opposite the tear the sclera is weakened for perfect buckling by:
 - a) The encircling band part behind the tear area is placed on more stretch than the rest of the band i.e. buckling at two pressure levels (Modification I).
 - b) Or half the scleral thickness is incised anterior and posterior to the band in a wider area than the tear meridians (Modification II).

The encircling band effect is sure to appear in the fundus especially in area posterior to the tear at a less buckling pressure avoiding the rare complications of pressure choroidopathy. Modifications I & II can be combined.

- 2: In case of a tear extending up to 6 mm. from optic disc (as a giant retinodialysis with inverted edge) the encircling oblique band is pushed with little finger to be placed in contact with optic nerve in meridians behind posterior edge of the tear (Modification III).

With the oblique encircling silastic band without evacuation of subretinal fluid, additional segmental radial or circumferential silastic 5 mm. rod buckling is not needed. They do not add more buckling effect to that of the band alone.

The buckling pressure choroidopathy closes the tear, stimulates some pigment epithelial cells migration towards pars optica retina, and give fissures in Bruch's membrane with quick passage of subretinal fluid to draining choroidal vessels thus quick absorption of subretinal fluid (Mortada theory).

Manny other problems are discussed as position of the band in relation to tears; management of factors causing non appearance of fundus buckling effect; dangers of evacuation of subretinal fluid on the buckling effect; the role of gelly vitreous counterpressure in closure of the tear; danger of application of the encircling band in proliferative diabetic retinopathy traction detachment; management of accidental loss of subretinal fluid, the unavoidable causes for failure of the operation, and the cheapest way to prepare the silastic band.

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