

# MACULAR BUCKLE WITH MORIN-DEVIN T IMPLANT FOR PATHOLOGICAL MYOPIA WITH MACULAR HOLE

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**Abstract:** Pathological Myopia is commonly associated with Myopic traction Maculopathy (MTM) which includes foveoschisis, foveal retinal detachment, macular hole (MH) and/or macular detachment (MD). Macular Buckling is a rarely practiced extraocular surgical modality these days. Purpose of this case report was to investigate the efficacy of primary buckling with Morin-Devin T implant for macular detachment with macular hole and posterior staphyloma. A 52 years female presented with Light perception vision in her Right eye with posterior staphyloma, localized Neurosensory detachment and macular hole underwent primary Macular Buckling with Morin Devin T implant. During the immediate postoperative day the wedge indentation was found misaligned to fovea. A revision surgery was done after 2 weeks for repositioning of the macular wedge. Spectral Domain Optical Coherence Tomography confirmed indentation at the macular hole with resolution of subretinal fluid and hole closure. Her BCVA was 2/60 at 3 months postoperative and it remained the same even at 6 months of follow-up. Primary macular buckling can be an effective procedure in eyes with Macular hole with detachment and posterior staphyloma with or without associated foveoschisis. Devin – Morin T implant placement is a relatively simple procedure with short surgical time and excellent outcome.

**Key Words:** Macular buckling, Morin –Devin T Implant, Myopic foveoschisis.

**P**athological Myopia with associated Myopic traction Maculopathy (MTM) is a relatively common posterior segment disease in Asian Population<sup>1</sup>. MTM includes foveoschisis, foveal retinal detachment, lamellar or full-thickness macular hole (MH), and/or macular detachment<sup>2</sup> and is generally associated with a posterior staphyloma<sup>3</sup>. OCT studies have shown frequent association of Myopic Foveoschisis with Macular hole with or without Retinal detachment and the pathogenesis and management of the same has inspired much debate in literature<sup>4</sup>.

Release of epiretinal traction by Pars Plana Vitrectomy with or without ILM peeling with gas or Silicon oil tamponade has enjoyed a reasonable success. However, PPV with ILM peeling in high myopic eyes is surgically challenging and is associated with low rate of macular hole closure and frequent complications<sup>5,6</sup>. Scleral wall modulation by scleral shortening or episcleral buckling have been reported with good anatomical and functional results<sup>7</sup>.

## METHODS AND SURGICAL TECHNIQUE

Morin-Devin T implant {France Chirurgie Instrumentation (FCI), Paris, France}: Morin Devin T implant has two components a 4mm wide silicone band and a 7 mm solid macular wedge (Figure 1A). The T-shaped macular buckle is created by threading the band through the solid silicone macular wedge's Plano Convex end (Morin-Devin "T"-shaped macular wedge)<sup>8</sup>. The horizontal line of the "T" is formed by the solid silicon band and the vertical line of the "T" is formed by the Macular wedge symbolically (Figure 2). Although the Indenting wedge end of the Macular Buckle is slightly convex on the non-indenting side but due to huge mismatch of convexity of the indenting and the non indenting side it would be more apt to call it plano convex.

180° temporal limbal peritomy was performed. Superior

(SR), inferior (IR), and lateral recti (LR), Inferior oblique (IO) muscles were carefully isolated and secured by anchoring sutures using muscle hooks. Care was taken to secure all muscle fibers during IO isolation.

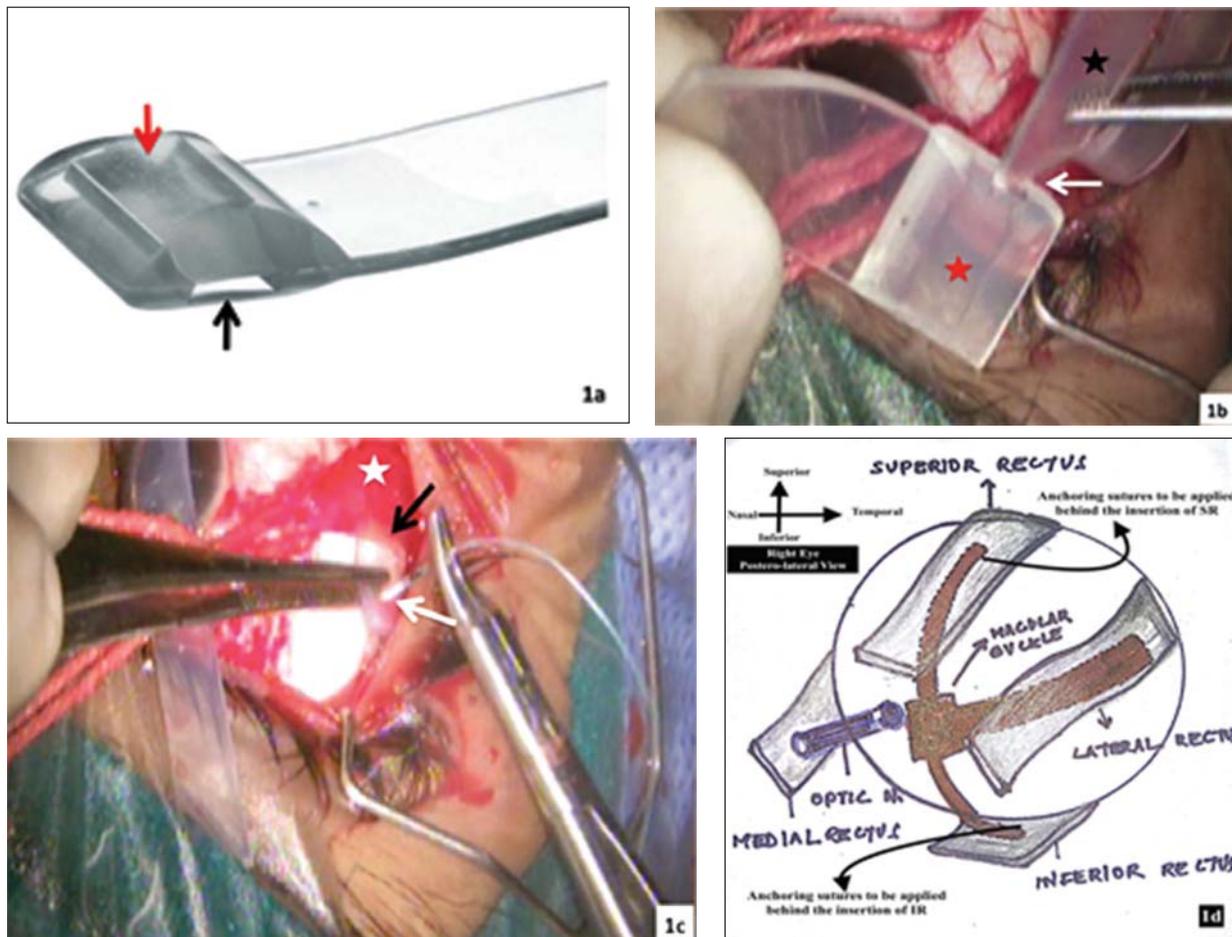
The 4 mm solid silicon band was first passed under the IR, IO and LR. After passing underneath the LR, in the plane between the LR and the SR the 4mm band was threaded through the slit provided in the indenting head of the macular wedge creating the T (Figure 1B, Figure 2).

The macular Wedge indenting head along with the threaded silicon band was then negotiated under LR. A long curved forceps holding the macular wedge tip was used to negotiate the Macular wedge and to place the indentation of Planoconvex wedge under the detached macular hole carefully. Care must be taken so that the convex indenting face of the wedge faces the sclera while negotiating under the LR. Simultaneous Indirect ophthalmoscopy with a +20 Diopter lens was used to confirm the desired indentation. Care was taken while manipulating the wedge to the desired position so that inadvertent trauma to optic nerve and short ciliary vessels could be avoided.

By our experience and from literature search accurate positioning of the indenting head is very important. The indenting head once placed produces enough visible indentation at the macular area. The desired indentation to be achieved is the indenting bump should be slightly below the edge of staphylomatous excavation. Placement of the macular wedge is enough to achieve the desired indentation in most of the cases.

In cases of extreme staphyloma increasing the tension on the 4 mm solid silicone band can be used to increase the indentation.

The free anterior end of the Macular wedge which formed the inferior end of the T was secured underneath LR by anchoring its superior and inferior borders to the sclera with

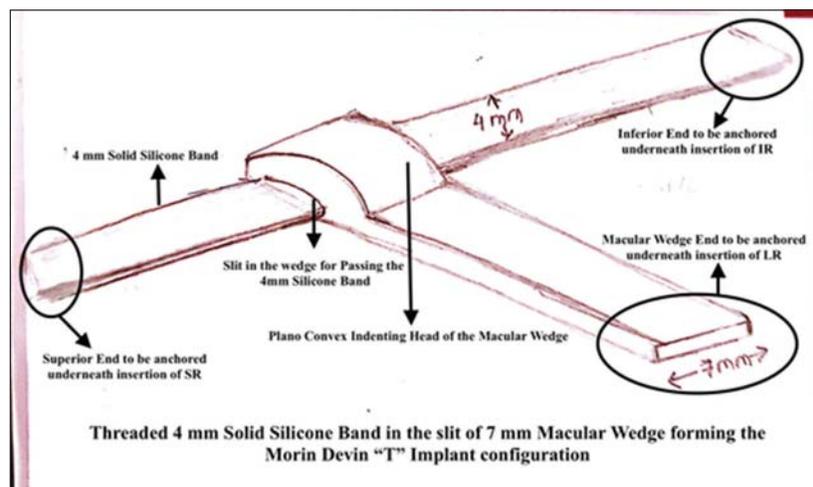


**Figure 1:** Morin-Devin T Implant. **1a.** 7 mm solid macular wedge with biconvex end. 'Red arrow' indicates the biconvex side of the macular edge, which will indent the Macular area. 'Black arrow' points to the slit in the solid macular wedge through which silicon band will be threaded. **1b.** Creation of T-shaped macular buckle by threading of 4mm silicone band through the solid silicone macular wedge's biconvex end 'white arrow'. 'Black star' points to the solid 4mm silicone band. 'Red star' points the solid macular wedge. **1c.** Anchoring of superior border of Macular wedge with 5-0 ethibond sutures to the sclera. 'White star' indicates the Lateral rectus (LR). Black arrow points to the superior border of LR. White arrow points to the passing of 5-0 ethibond suture through the 7mm macular wedge and being anchored to the sclera at the superior border of LR. **1d.** Three-dimensional drawing of Right eye with Morin-Devin T implant from a posterolateral point of view. x & y label in figure shows free anterior end of the 4mm band secured nasal to insertion of superior and inferior rectus respectively. z label in figure shows free anterior end of the Macular wedge secured to sclera underneath LR.

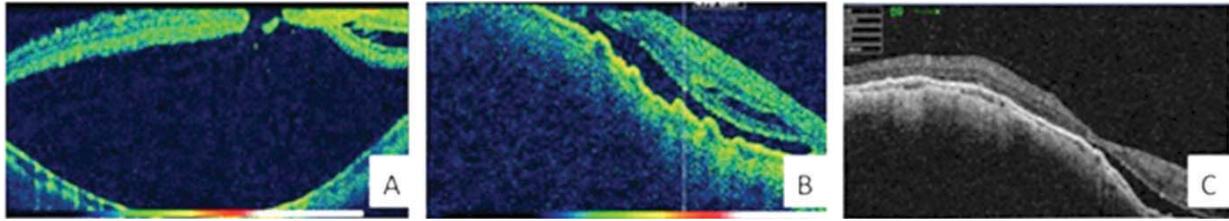
5-0 Ethibond suture. 3 anchoring sutures were passed at the superior border and 2 at the inferior border of the 7 mm silicon macular wedge to prevent future displacement (Figure 1C).

The 4 mm band was passed underneath the SR. Extra long superior band was discarded and the cut end was secured nasal to the insertion of SR with 5-0 ethibond sutures. The inferior end of the 4 mm band was similarly fashioned and anchored nasal to the insertion of IR. Tenon and Conjunctiva were secured with 8-0 polyglactin suture. The final position of the buckle with respect to the muscles is shown in (Figure 1D).

In this case Primary External Macular Buckling (PEMB) was only performed. In cases of subrotal Retinal detachment and especially detachment limited to the staphylomatous area or upto the vascular



**Figure 2:** Three-dimensional drawing of the final configuration of the solid silicone Band and Macular wedge after threading of the band into the slit provided at the indenting head of the Wedge forming the "T" configuration. Also mentioned are the respective ends to be anchored underneath insertion of different muscles.



**Figure 3:** SD-OCT showing reattachment after macular buckling with Morin-Devin T implant. **A.** Pre-operative OCT showing macular hole with posterior ectasia of scleral wall. **B.** 1 month post-op OCT showing persisting Macular hole with significant indentation at the Fovea. **C.** 3 month follow-up showing closure of macular hole with persisting of detachment nasal to fovea.

arcade no drainage of subretinal fluid needs to be done. The macular fluid gets absorbed gradually. It may take few days to months for complete reabsorption of the fluid. In cases of extensive retinal detachment subretinal fluid can be drained from a peripheral location. Air or gas tamponade can be used for the same. Available literature for Primary External Macular Buckle have a success rate of around 90%.

In cases where Macular Buckling is combined with an Ab Interno drainage can be during Fluid Air Exchange the site of which the authors leave it to the discretion of the surgeon. However, authors avoid draining subretinal fluid through Macular hole and prefer it from a peripheral retinotomy site.

### CASE SUMMARY

We report a case of a 52-year-old woman who had Posterior staphyloma with MH and Macular Detachment limited to vascular arcade in right eye (Figure 3A). Patient underwent Primary Macular Buckling with Morin Devin T implant as described above.

Postoperatively, however the indentation of macular buckle was infero-temporal to the fovea. Patient underwent a revision Buckling surgery after 2 weeks. Satisfactory results were obtained intraoperatively and postoperatively after the revision surgery (Figure 3B).

At 3 months follow up, BCVA improved to 2/60. SD-OCT showed significant buckle effect and resolution of macular detachment with hole closure (Figure 3C). A persistent restriction of eye movement on Lateral Gaze was noted at last follow up. The visual acuity remained static even at 6 months of follow-up.

### DISCUSSION

MTM in varying severity invariably coexist with posterior staphyloma. Progressive axial elongation along with antero-posterior vitreous traction

and taut Internal Limiting membrane creates shearing forces responsible for foveochisis with or without MH and retinal detachment<sup>9</sup>.

Various authors have reported significant success of Pars Plana Vitrectomy with ILM peeling and tamponade in MTM<sup>5,10</sup>. Significant surgical expertise is required while working in an eye with abnormal scleral rigidity, longer axial length, mismatched instruments to axial length size and visibly reduced contrast at the posterior pole due to myopic degeneration. Low MH closure rates, development of extrafoveal holes, progression of foveochisis post ILM peeling<sup>11</sup> and re-detachment post tamponade removal mars its eventual success rate and its real success is questionable.

Macular buckling addresses the pathology by changing the configuration of the posterior pole from concave to a plano-convex thus, relieving anteroposterior and tangential traction, sclero retinal mismatch and also reinforces the RPE and neurosensory retina adherence by bringing them together in a chorioretinal atrophied area.

Although eclipsed by PPV for a long time macular buckling has shown resurgence in recent times with reports coming from various centres emphasizing high success rates of Macular Buckling with or without vitrectomy. In a case series reported by Ando F et al comparing episcleral macular buckling (EMB) versus PPV in eyes with retinal detachment due to macular hole with posterior staphyloma, the retinal reattachment rate in EMB group was 93.3% after primary surgery and 100% after secondary surgery. In the PPV group, the retinal reattachment rate was 50% after primary surgery and 86% after secondary surgery using the EMB procedure, thus indicating a better anatomical success rate after primary EMB than after primary PPV<sup>12</sup>. Many case series with primary EMB or EMB with PPV have reported higher anatomical and

functional success rate over primary PPV alone<sup>13</sup>.

Different Macular Buckles have been described in literature. The most popular one is the Ando Plombe Explant (Ondeko Corporation Japan). It is a solid silicone rod with metallic wire inside, that allows it to be bent to obtain the desired buckling effect of the macular area. Mateo et al coupled the indenting head to a 30 Gauge optical fiber, which can be turned off and on, to help in accurate placement of the buckle by transillumination<sup>14</sup>.

Similar to Ando plombe explant is the AJL macular buckle (AJL Ophthalmic Spain). This buckle is made up of PMMA material covered with silicone to increase its biocompatibility. It has a spherical indentation head while the Ando Plombe has an ellipsoidal head. In order to get optimum indentation the arm length and curvature in AJL is customized to individual's eye. AJL can also be coupled with optical fiber for guided placement using transillumination. Both Ando Plombe and AJL can be easily placed by just exposing the supero-temporal quadrant and thus scores over other macular buckles. However, indentation with the above buckles cannot be accurately titrated intraoperatively. The biggest deterrent is the cost of these explants in South Asia, which is almost fifty to hundred times more than Morin Devin T implant.

Another commonly used Macular buckle is the Adjustable Macular Buckle (AMB) which has solid silicone handle with terminal plate for indentation<sup>15</sup>. The terminal plate has two winglets on either side for passing mersilene suture. The two ends of the suture are circumnavigated and tied in the opposite quadrant under Medial Rectus. The indentation can be increased or decreased by tightening or loosening the suture postoperatively. The main disadvantages are longer learning curve and requirement of LR disinsertion for securing the explant under LR.

Some authors have also reported

use of solid silicone sponge with or without a metal wire (L shaped macular Buckle and Wire-strengthened sponge exoplane)<sup>15</sup>. However, long term safety of the metal wire is not known and extrusion of sponge is a real concern from these explants. Also intraoperative and post-operative titration is not possible. Suturing of silicone tyre and sponge by direct visualisation of the staphylomatous area has been used in past but require disinsertion of muscles for macular exposure and there lies risk of perforation of extremely thin staphylomatous area.

Complexity of different procedures and unfamiliarity has dissuaded Macular Buckling becoming popular especially in Indian Subcontinent. Morin Devin T implant scores a huge economic advantage. Unlike other procedures the T implant doesn't require muscle disinsertion, posterior suture and any open surgical access to posterior pole making the procedure relatively simple. Inherent disadvantages of macular buckle like intraoperative risk of scleral perforation, compromise of short posterior ciliary circulation, damage to ONH, abduction deficit, misalignment under the fovea and late development of chorioretinal atrophy exists in T implant too.

In our first attempt we had buckle misalignment. This can be prevented by using a customised curved forceps for placing the macular wedge, ability to differentiate false indentation produced by instrumentation and better hand and eye coordination. Transillumination with an optical fibre has been used with other implants. No such commercially available modifications are available with Morin Devin T implant. An extrapolation can be done by using a retaining suture to fix a fiberoptic cable at the macular wedge which can be used to confirm the macular indentation and later removed by pulling

off the fiber optic cable. Another way which various authors have used in another case is to use a 25 Gauge self-retaining chandelier endoilluminator along with wide angle viewing system to confirm the appropriate indentation.

In our case we achieved satisfactory chorioretinal apposition and closure of Macular hole though with abduction deficit at 3 month follow up on SD-OCT. We believe that MTM with co-existing pathology can be addressed with scleral wall reshaping using a relatively simple technique of macular Buckling with Morin -Devin T implant.

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