A New L-Shaped Design of Macular Buckle to Support a Posterior Staphyloma in High Myopia

Macular foveoschisis, macular detachment (MD) without macular hole, and macular detachment with macular hole could be different stages of a progressive disease well described as myopic traction maculopathy.[1–3]

The pathogenesis and natural history of myopic traction maculopathy are still uncertain, and the best management is debated.[4] Elimination of epiretinal tractions by means of vitrectomy with or without internal limiting membrane peeling seems an acceptable approach and has proven to be effective.[5–8] Vitrectomy alone, however, causes a transient release of the traction[9] without addressing the major risk factor of the macular foveoschisis, which is the posterior staphyloma.[10]

Furthermore, it should be noted that vitrectomy with internal limiting membrane peeling, in highly myopic eyes, may lead to complications, such as macular hole formation, extrafoveal retinal hole formation, or physiologic changes in the macular area.[8]

To give a new shape to the posterior scleral wall, the issue of the posterior staphyloma, by the use of a scleral buckle alone, has been previously reported with good anatomical and functional results.[11–13]

The authors of this article think that an L-shaped buckle design (see **Video, Supplemental Digital Content;** http://links.lww.com/IAE/A158) is the easiest to place and leads to the lowest risk of intraoperative and postoperative complications. However, it has been used always in combination with vitrectomy.

Besides, the newest designs of macular buckle (by Ando and by Stirpe) are not widely available on the market.

The present study has a dual purpose. First, we aimed to study the role of the macular buckle alone, in releasing the anteroposterior and tangential tractions of macular foveoschisis, in cases of MD not associated to macular hole.

Second, we wanted to test the feasibility, tolerability, and safety of a new L-shaped buckle, which can be made in the operating room.

Materials and Methods

A thorough informed consent was obtained from the patients. Three eyes of three patients affected by MD and three eyes of three patients with macular detachment with macular hole were operated with a new L-shaped macular buckle.

Preoperatively, the eyes were examined with spectral-domain optical coherence tomography (Optos, Dunfermline, Scotland, United Kingdom). Six radial scans were obtained. The height of the MD was measured in the highest point. Other preoperative data were visual acuity and intraocular pressure. Postoperative visual acuity and optical coherence tomography scans were evaluated 1 week, 1 month, and 3 months after surgery. The postoperative scans were aligned with preoperative for comparative measurements.

Surgical Technique

The surgical technique was as follows: the conjunctiva and the Tenon capsule were incised at the limbus, in the superotemporal and inferiortemporal quadrants. The lateral and superior rectus muscles were isolated with a suture to favor the motility of the eye and were not detached.

The macular buckle was prepared using a silicone sponge (Labtician 507 oval sponge) 7 mm large, 5 mm thick, and 3 cm long. The sponge was thinned for a length of 2 cm to make the buckle more prominent in the one third intended to be placed under the macula (head of the buckle) and thin in the two remaining thirds (tail of the buckle), intended to allow to suture the buckle anteriorly (Figure 1A). A tunnel was created into the silicone sponge with 19-gauge needle. A malleable titanium stent (Mod MCP6TP, Tekka, Pesaro, Italy) 15 mm long, 2 mm wide, and 0.5 mm

From the *S. Anna Hospital, Brescia, Italy; and †Sacro Cuore Hospital, Verona, Italy.

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Reprint requests: Barbara Parolini, MD, Istituto Clinico S. Anna Hospital, Via del Franzone, 31, 25127 Brescia, Italy; e-mail: parolinibarbara@gmail.com

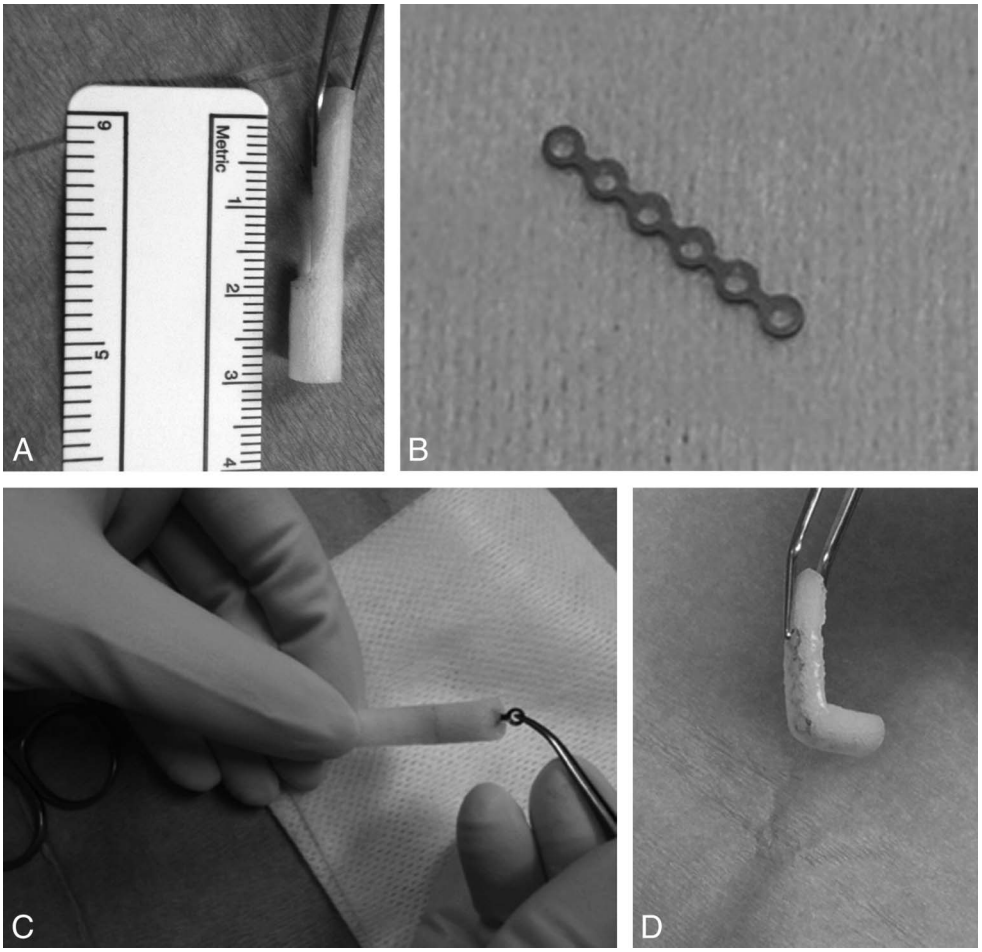

Fig. 1. A. The macular buckle made with a silicone sponge 7 mm large, 5 mm thick, and 3 cm long. The sponge was thinned for a length of 2 cm to make the buckle more prominent in the one third (head of the buckle) and thin in the two remaining thirds (tail of the buckle). **B.** A malleable titanium stent 15 mm long, 2 mm wide, and 0.5 mm high. **C.** The titanium stent was inserted and hidden into a tunnel created into the silicone sponge with a needle. **D.** The sponge was bent to obtain an L-shaped buckle by creating a 90° angle between the head and the tail of the buckle.

high (Figure 1B) was inserted and hidden into the tunnel (Figure 1C). The sponge could than be bent to obtain an L-shaped buckle by creating a 90° angle between the thick part and the thin part (Figure 1D).

Monitoring the fundus by a binocular ophthalmoscope revealed to be too difficult. A better view was obtained by watching the fundus through a panoramic system (BIOM, Oculos) attached to the microscope and by illuminating the fundus with one of the 27-gauge twin lights (DORC, Zuidland, The Netherlands) inserted through the sclera, 4 mm from the limbus. The other 27-gauge light fiber was inserted into the head of the buckle to transilluminate the fundus and facilitate the check of the final position of the buckle.

The buckle was slid, head down, into the superotemporal quadrant (Figure 2A), aligned to the lateral rectus muscle, and held by a forceps (Figure 2B) until the head induced a good indentation of the macula, as observed through the BIOM and with transillumination. At that point, an assistant could mark the upper limit of the tail of the buckle on the sclera, in the superotemporal quadrant, to know where to place the suture. The tail of the buckle was than fixed to the sclera with two 6-0 T-cron mattress sutures placed about 10 mm from the limbus (Figure 2C). Figure 2D shows the position of the buckle on a model. The Tenon and the conjunctiva were sutured with 6.0 Vycril. A 0.3 mL bubble of SF_6 gas was injected in the vitreous chamber with a syringe and a 30-gauge needle, and the intraocular pressure was adjusted with a paracentesis in the anterior chamber. Patients were asked to maintain the facedown position for 3 days.

Results

Patients were followed up for 6 months. No intraoperative or postoperative complications were noted. The intraocular pressure remained normal during the follow-up in all eyes.

The retina in macular detachment with macular hole (Figure 3A) was attached, and the macular hole was completely closed the day after surgery and remained attached during the follow-up (Figure 3B).

Preoperative best-corrected visual acuity was 2 logarithm of the minimum angle of resolution in all eyes and reached 0.7, 0.4, and 1 logarithm of the minimum

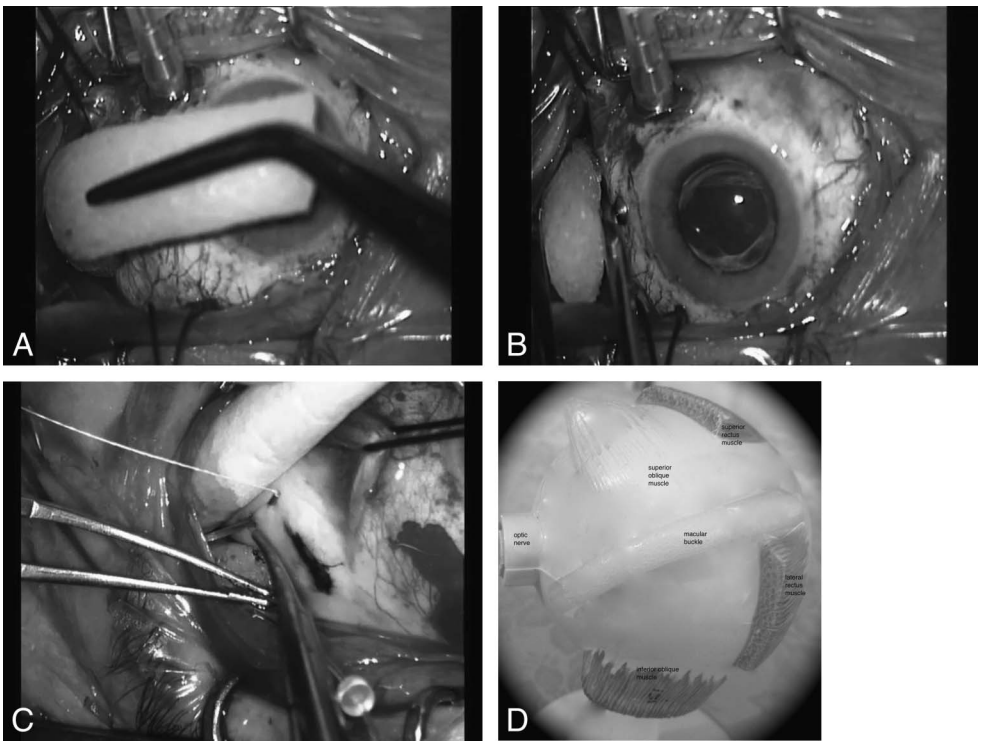

Fig. 2. A. The buckle is inserted head down into the superotemporal quadrant. **B.** The buckle is aligned to the lateral rectus muscle and held by a forceps. **C.** When the buckle is inserted into the superotemporal quadrant, the upper limit of the tail of the buckle was marked on the sclera. The tail of the buckle was then fixed to the sclera with two 6-0 T-cron mattress sutures placed about 10 mm from the limbus. **D.** Position of the buckle on an eye model.

angle of resolution, respectively, within the 6-month visit.

The 3 eyes with MD (Figure 4A) showed a progressive decrease in the height of the MD at optical coherence tomography during the follow-up of 3 months (Figure 4, B and C). Preoperative best-corrected visual acuity was 0.8, 0.7, and 0.6 and reached 0.6, 0.5, 0.4 logarithm of the minimum angle of resolution, respectively, within the 6-month visit.

Discussion

In this study, we made a macular buckle in silicone sponge and a titanium stent. Many different buckling techniques have been proposed in the history of the surgery of high myopia. They have been described mainly to treat cases of macular detachment with macular hole: a radially placed polyethylene tube,[14] a silver ring, later modified, attached to the limbus with an arm fixed to the ring with a terminal ball to indent the retina,[15,16] a vertically placed 2-mm-thick silastic rod,[17] and an oblique circlage.[18]

A silastic sponge rod placed between the inferior oblique insertion and the optic nerve.[12] All the listed buckle designs have been abandoned for intra- or postoperative complications and for the surgical challenge. A more recent design of macular buckle has been proposed by Ando et al.[19] Ando et al used a silicone plate, containing a stainless steel wire. The wired plate can be bent to reach a curved shape. The Ando plomb design is considered to be easier to apply, because it does not require posteriorly placed suture or to pass bands from the superior to the inferior quadrants. Zhu et al[22]

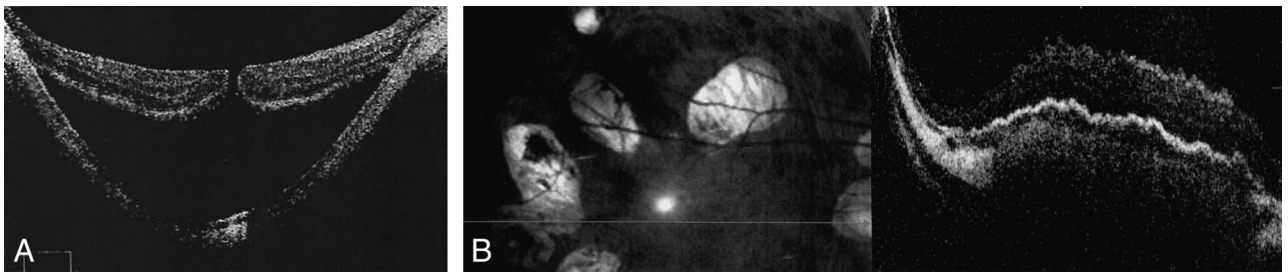

Fig. 3. A. Preoperative OCT of a high myopic eye with MD because of macular hole. **B.** Optical coherence tomography of the same myopic eye 1 day postoperative. The retina was attached, and the macular hole was completely closed. OCT, optical coherence tomography.

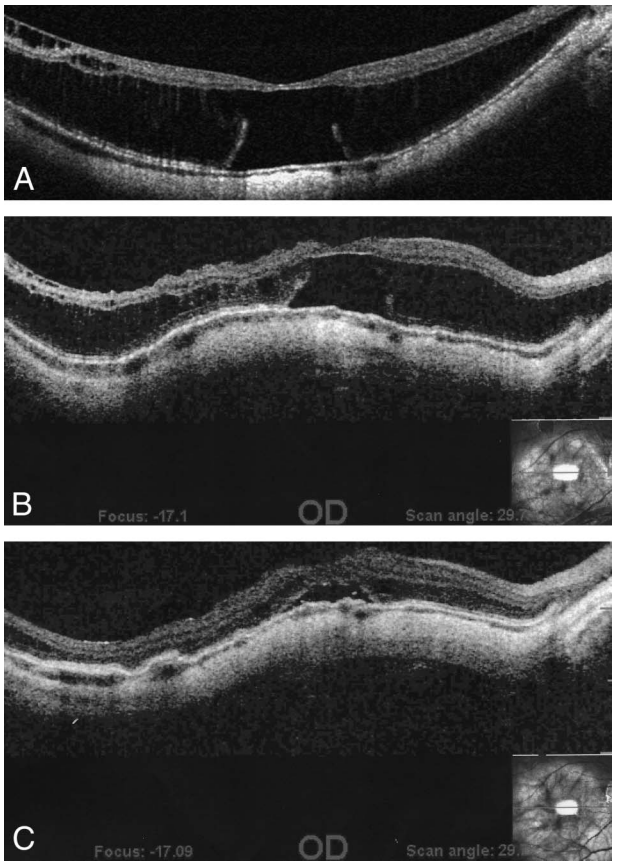

Fig. 4. A. Preoperative OCT of a high myopic eye with MD without macular hole. **B.** Optical coherence tomography of the same eye with 2 weeks postoperative. **C.** Optical coherence tomography of the same eye with 3 weeks postoperative. OCT, optical coherence tomography.

published the use of a buckle for schisis and detachment without hole. However, their technique implied to pass a scleral band plus a "foreign-body scleral buckle of 12 by 14 mm." Recently, a silicone C-shaped macular buckle with adjustable sutures has also been proposed by Stirpe et al[23] in a few cases.

Our procedure may be safer than previously described methods of episcleral macular buckling because, as well as the Ando plomb, it does not require posterior sutures or direct access to the posterior pole. In fact, no intraoperative complications were encountered, in contrast to other recent publications.[24]

This technique can be performed without the need of specially designed buckles, which are not commercially available in all countries. The Ando plomb is made of steel. Conversely, we used a titanium stent as a tool to shape the buckle.

Based on our observation, a buckle alone can progressively solve the internal tractions, sustaining an MD without hole. The shape of the posterior staphyloma was flattened by the indentation of the buckle. The subretinal fluid was not intended to be actively drained. In fact, in these types of MD, the amount of subretinal fluid is limited and localized under the fovea. Any external drainage maneuver was considered too dangerous.

The injection of a gas bubble was intended to favor the attachment of the retina to the retinal pigment epithelium, in conjunction with the buckle.

However, because the subretinal fluid disappeared slowly, the authors think that the gas injection is likely unnecessary.

The surgeon (B.P.) had tested this buckle over the past 4 years, in more than 40 patients, making a few changes in the design, in combination with vitrectomy. The buckle was well tolerated by the patients (unpublished data). The main advantage, in combination with vitrectomy, in cases of MD without macular hole, was that the buckle prevented the formation of an iatrogenic macular hole. Furthermore, in cases of macular hole–MDs, the buckle allowed not only to reattach the retina but also to effectively close the hole. More recently, the author implanted the buckle alone. The procedures were quick, easy, and effective. The management of a macular hole-MD with the insertion of an L-shaped macular buckle is faster, safer, easier to perform, and more effective than the combination of vitrectomy, ILM peeling, and insertion of a macular buckle.

We decided to publish only the cases performed with a buckle alone, although only a few cases, to demonstrate the potentialities of the buckle and avoid possible influences of additional maneuvers. The success of this surgery shows how the posterior staphyloma and the anteroposterior tractions play a very important role in the pathogenesis of the myopic traction maculopathy.

We think that the buckle is not just important but indispensable, to flatten the posterior staphyloma, and should be used first alone without vitrectomy, to prevent possible complications related to the peeling of vitreoretinal tractions alone.

Only in case of nonsuccessful results of the buckle, vitrectomy should be considered to relieve the tangential tractions.

Key words: macular buckle, myopia, macular detachment, macular hole.

*BARBARA PAROLINI, MD**
*RINO FRISINA, MD**
*SAJISH PINACKATT, MD**
MAURIZIO METE, MD†

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