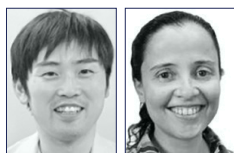


# UNCONVENTIONAL BUCKLING TECHNIQUES: CONTROLLING MTM

When faced with myopic traction maculopathy, consider using a macular buckle.

BY HISASHI FUKUYAMA, MD, PHD, AND AMANI A. FAWZI, MD



Scleral buckling is generally used to support peripheral retinal breaks to allow permanent closure, reduce vitreoretinal traction, and promote long-lasting chorioretinal adhesion.

The buckling technique achieves these effects by bringing the retinal pigment epithelium (RPE) closer to the retina, which allows the subretinal fluid to be reabsorbed and leads to retinal reattachment.<sup>1</sup>

Scleral buckling techniques evolved from scleral resection, a procedure initially developed to reduce the size of the eyeball or strengthen the sclera and prevent stretching.<sup>2</sup> In response to the complications associated with this approach, in 1949, Ernst Custodis designed an explant to produce a buckling effect for retinal detachment (RD) repair.<sup>3</sup> Since then, many buckling techniques have been developed to treat RD.<sup>4</sup>

The volume of scleral buckling procedures has decreased as vitreoretinal surgeons, especially those who are young, increasingly perform pars plana vitrectomy (PPV) to repair primary rhegmatogenous RDs.<sup>5,6</sup> However, scleral buckling has applications for many retinal conditions, including the treatment of myopic traction maculopathy (MTM). Macular buckling is a modified scleral buckling technique in which the buckle is placed in the posterior pole to provide scleral indentation in the area of the macula.

## MYOPIC TRACTION MACULOPATHY

MTM refers to a broad clinical spectrum of conditions estimated to affect between 9% and 34% of eyes with pathologic myopia.<sup>7-9</sup> MTM-inducing forces can lead to macular pathologies, such as macular schisis and macular detachment, inner lamellar macular hole, and full-thickness macular hole (Figure 1).<sup>10</sup>

There are several classifications for MTM. Shimada et al described retinoschisis in five stages and progression from macular retinoschisis to RD.<sup>11,12</sup> Ruiz-Moreno et al proposed a classification and grading system for myopic maculopathy (ATN classification) that includes MTM.<sup>13</sup> Parolini et al

recently proposed a comprehensive OCT-based classification of MTM.<sup>10</sup> These classifications are based on the progressive nature of MTM, with progressively decreasing vision.<sup>10,12,14</sup>

## SURGICAL MANAGEMENT

The best surgical approach to MTM is a subject of debate. Though some researchers suggest that early-stage MTM can be observed because spontaneous improvement may occur,<sup>12,15</sup> most ophthalmologists agree that surgery should be performed when patients' visual acuity decreases and when they enter severe, sight-threatening stages of MTM, such as foveal detachment and macular hole RD (MHRD).<sup>16-18</sup>

Schepens described the macular buckling technique for the first time in 1957,<sup>19</sup> and other researchers later reported the efficacy of this treatment in eyes with MHRD.<sup>20,21</sup>

PPV wasn't introduced as a treatment for MHRD until the 1980s.<sup>22,23</sup> Different types of intravitreal tamponades (eg, gas, silicone oil) and surgical techniques (internal limiting membrane [ILM] peeling and laser treatment) have been proposed for PPV for MHRD. However, anatomic results showed limited primary success rates for vitrectomy in highly

## AT A GLANCE

- Scleral buckling has applications beyond primary rhegmatogenous retinal detachment, including for the treatment of myopic traction maculopathy.
- A review showed that resolution of foveoschisis, retinal reattachment, and macular hole closure were achieved more frequently with macular buckling than with vitrectomy.
- Intraoperative OCT may prove useful for confirming the accurate positioning of a macular buckle.



Figure 1. OCT imaging demonstrates macular schisis and subretinal fluid in the left eye of a patient with MTM. A high-density OCT scan through the fovea should be used to identify a small macular hole.

myopic eyes.<sup>24</sup> In addition, postoperative recurrence and postoperative macular hole recurrence have been reported in patients who undergo vitrectomy.<sup>25</sup> These postoperative events may be related to the extended axial length and the persistent tangential traction on the retinal surface, related to posterior staphyloma, that remain after vitrectomy.

Modified vitrectomy approaches, such as foveal-sparing ILM peeling and inverted flaps, were recently proposed to improve anatomic outcomes, but the role of these approaches in MTM remains unclear. Furthermore, a review of 31 articles published over the course of 16 years comparing macular buckling with PPV for the treatment of MTM suggested that complete resolution of foveoschisis, retinal reattachment, and macular hole closure were achieved more frequently with macular buckling than with PPV.<sup>26</sup> A recent randomized controlled study showed that macular buckling was superior to vitrectomy with ILM peeling plus gas tamponade for the surgical treatment of macular schisis and associated MHRD in high myopia.<sup>27</sup> These studies have renewed researchers' and clinicians' interest in the macular buckling technique.

### Macular Buckle Updates

The centrifugal MTM-inducing forces are both perpendicular and tangential to the retinal plane. The goal of macular buckling is to support the posterior staphyloma area by reducing various shearing forces and stretching and help to prevent the eventual failure of internal retinal structures, all of which are thought to induce MTM (Figure 2). The options for macular buckling include an ab externo approach with silicone bands or macular plombs. To date, the commercially available macular buckles are as follows:

- Ando Plombe (Ondeko)
- T-shaped scleral buckle (FCI, a Carl Zeiss Meditec Company)
- NPB macular buckle (AJL Ophthalmic)
- Adjustable MB (Micromed)

In the 2000s, macular buckling with a sponge and a solid

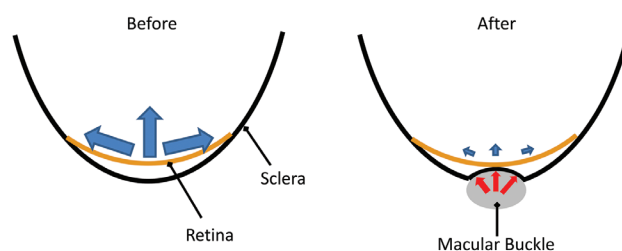


Figure 2. This schematic represents the forces before and after macular buckling for MTM.

silicone implant provided high reattachment rates for myopic MHRD,<sup>28,29</sup> although it is a technically challenging procedure. Several updates to the buckle designs aimed to improve the surgical technique. For example, a T-shaped, semirigid, silicon rod-explant reinforced with titanium wires with an indenting head was proposed as an approach to MHRD in 2005.<sup>28</sup> An L-shaped buckle with a titanium stent inserted into a silicon stent, allowing a macular indentation and anterior suture, was proposed to support a posterior staphyloma.<sup>30</sup> Suprachoroidal buckling has also been proposed for MTM. In one technique, a catheter is used to deliver long-lasting hyaluronic acid into the suprachoroidal space in the area of the staphyloma in patients with MTM.<sup>31</sup>

### VISUALIZATION OPTIONS

Despite the innovations described earlier, macular buckling remains a challenging surgery. One of the principal challenges is optimal positioning of the buckle. Some researchers reported using external posterior landmarks and adjustable macular buckles to facilitate better positioning of the indenting head, but this was associated with potential injury to the extraocular muscle.<sup>32,33</sup> To avoid this problem and enhance visualization, Mateo et al proposed the insertion of an optical fiber coupled to an Ando Plombe, which allowed better visualization and positioning of the explant with an internal chandelier-assisted technique.<sup>34</sup> A few recent case reports also showed the efficacy of internal chandelier-assisted techniques using a widefield contact lens system to repair myopic macular holes.<sup>35,36</sup>

Intraoperative OCT allows real-time visualization of the retinal layers and could provide important guidance for surgical decision making.<sup>37</sup> Intraoperative OCT may prove useful for confirming the accurate positioning of a macular buckle. This technology may help surgeons overcome potential causes of surgical failure, such as excessive or insufficient posterior indentation, by allowing them to diagnose and address problems intraoperatively.

### RETHINKING THE MACULAR BUCKLE

The macular buckling technique offers significant benefits for the treatment of MTM. Future advanced techniques and technologies may one day allow ophthalmologists to achieve even better surgical outcomes and wider clinical utility. ■

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