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New Instruments

NEW SURGICAL INSTRUMENT FOR AUTOLOGOUS INTERNAL LIMITING MEMBRANE TRANSPLANTATION FOR THE TREATMENT OF REFRACTORY MACULAR HOLES

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Macular hole (MH) diameter has a strong influence on postoperative anatomical and functional results. The inverted internal limiting membrane (ILM) flap technique improves anatomical and functional outcomes of vitrectomy for large MHs with a minimum diameter exceeding 500 μm .¹ However, improvements in these procedures have not resulted in 100% satisfactory surgical outcomes. In some cases of idiopathic MHs, initial surgery using the inverted ILM flap technique fails to achieve MH closure, while the ILM has been previously removed in others. In such cases with refractory MHs, Morizane reported that autologous transplantation of the ILM resulted in a success rate of 90%.² However, it is often difficult to harvest and place a suitably sized free ILM flap into the MH,³ and the procedure is relatively invasive to the retinal pigment epithelium

and neural retina. To address this issue, we developed a new instrument that can harvest and push the free ILM flap safely and reliably into the MH.

Methods

Designed for 25-gauge vitreous surgery, the instrument has a 38-mm stainless steel shaft and a handle portion of 76 mm, which can be adapted to cases of high myopia (Figure 1). A 2-mm silicone tip at the end of the stainless steel shaft provides excellent flexibility and serves to reduce mechanical invasion to the retinal pigment epithelium and neural retina when placing the free ILM flap into the MH. The end of the silicone tip contains a spherical silicone component with a diameter of 480 μm , the shape of which ensures minimal adhesion of the free ILM flap (Figure 2). To facilitate smooth insertion into the trocar with the closure bulb, a movable stainless steel T-tube with an outer diameter of 0.9 mm, an inner diameter of 0.6 mm, and a length of 6.0 mm is installed on the shaft.

Results

The residual ILM is stained with 0.025% Brilliant Blue G (BBG 250; Sigma-Aldrich, St. Louis, MO) to identify the area containing the remaining ILM. After creating a suitably sized ILM flap using vitreous forceps, the dispersed viscoelastic material is injected from just above the macula to the extent that it flows over the MH. The prepared ILM flap is

Fig. 1. Image of the new autologous ILM transplantation device. The 25-gauge, 38-mm stainless steel shaft is adapted with a handle portion of 76 mm. There is a 2-mm silicone tip at the end of the stainless steel shaft. The very end of this silicone region contains a spherical silicone component with a diameter of 480 μm .

Fig. 2. Images of the tip of the new autologous ILM device (A). A 2-mm silicone top at the end of the 25-gauge stainless steel shaft provides excellent flexibility (B).

peeled off, transported into the viscoelastic material on the MH using vitreous forceps, and attached (Figure 3). The contracted free ILM flap in the viscoelastic material is pushed and expanded into the MH using the new instrument (Figure 4), and fluid–air exchange is performed (see **Video, Supplemental Digital Content 1**, which demonstrates how to use this instrument, <http://links.lww.com/IAE/A737>). In all six cases, optical coherence tomography findings revealed that the postoperative ILM flap was present in the MH, and complete MH closure was observed in five cases. No

Fig. 3. Intraoperative photograph of autologous ILM transplantation. The free ILM flap is transported into the viscoelastic material over the MH using vitreous forceps.

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adverse effects on retinal structure were noted in any case. The clinical use of this device was in full compliance with the guidelines of the Declaration of Helsinki and approved by the Institutional Review Board/Ethics Committee of Toho University Sakura Medical Center (S-16077).

Discussion

Although autologous ILM transplantation is effective for the treatment of refractory MHs, various complications may occur during the procedure. The most difficult step of ILM transplantation involves the transportation and placement of the free ILM flap into the MH using vitreous forceps. Releasing the ILM after it has been grasped by the forceps is difficult, and the contracted free ILM flap is unlikely to remain in place. Although the use of vitreous forceps renders adherence to a free ILM flap less likely, the use of perfluorocarbon liquids during the surgery as described by Park et al⁴ may have a similar effect.

Herein, we report that the use of this new instrument allows for safe placement of the contracted free ILM flap into the MH in cases of refractory MH. Thus, this

Fig. 4. Intraoperative photograph of autologous ILM transplantation using the newly developed device. The contracted free ILM flap in the viscoelastic material is pushed and expanded into the MH using the new instrument.

new instrument may improve the success rate of autologous ILM transplantation and facilitate safer placement of the inverted ILM or neurosensory retinal free flap⁵ into large MHs.

Key words: internal limiting membrane, refractory macular hole, autologous transplantation, vitrectomy, surgical instrument.

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