

Abstract 392

A NOVEL SURGICAL TECHNIQUE FOR GIANT AND REFRACTORY MACULAR HOLES: AUTOLOGOUS TENON CAPSULE PLUG

Avci R.*, Mavi Yildiz A., Yilmaz S.

Retina Eye Hospital ~ Bursa, Turkey ~ Turkey

Introduction:

The standard gold treatment for idiopathic macular hole (MH) including pars plana vitrectomy (PPV), internal limiting membrane (ILM) peeling, and gas tamponade, provides high success with primary closure rates exceeding 90% (1). However, very large (> 600 µm), chronic, or recurrent holes generally demonstrate lower closure rates and the ideal surgery is still a dilemma for those challenging cases (2,3). Up till now, there is no consensus as to which technique to use in refractory macular holes.

Recently, several autologous biologic scaffolds have been described and used to achieve higher closure rates for complicated MHs including; inverted ILM flap, autologous ILM transplantation, anterior lens capsule flap, and autologous retinal graft transplantation (ART) (4-7). Among those methods, the inverted ILM flap technique, which was first described in 2010 by Michalewska et al, has received the most attention with very high success rates reaching 98% (8-10). However, traditional ILM peeling and even ILM flap variations are not feasible for previously vitrectomized eyes with complete ILM peeling.

Later on, in 2018, Rizzo et al. proposed the use of a human amniotic membrane (hAM) patch for recurrent MHs with a high anatomical and remarkable functional success rate. However, the preparation, storage, and transport of the hAM is not available in many centers, and concerns about sterilization still limit its widespread use in ophthalmology (11).

This study aimed to describe a novel, simple, and repeatable surgical technique for the treatment of giant and refractory macular holes. In this paper, we report the long-term clinical data of 3 patients who underwent autologous Tenon capsule plug (ATCP) for giant and/or refractory MH.

Materials and methods:

This retrospective, interventional, case series included 3 patients who underwent 23-gauge pars plana vitrectomy (PPV) and ATCP technique for giant or refractory full-thickness macular hole (FTMH). Of the cases, 2 had an idiopathic MH that failed to close after standard PPV with (internal limiting membrane) ILM peeling and the remaining case, who had a giant FTMH with a minimum diameter of 1140 µm, underwent the ATCP technique as the primary intervention. All patients underwent a complete ophthalmic examination including optical coherence tomography (OCT), OCT angiography (OCTA), and microperimetry (MP). The changes in retinal structure and function were evaluated during the follow-up.

Results:

The minimum follow-up was 6 months. The preoperative minimum hole diameters were 728 µm, 422 µm, and 1154 µm for case 1, case 2, and case 3 respectively. Case 1 and case 2 had undergone conventional PPV and ILM peeling priorly, whereas case 3 had a giant, irregular MH with grade 4 epiretinal membrane (ERM). The en-face OCTA images showed that the ILM was peeled up to the

vascular arcades during the initial surgery in case 1 and case 2. Complete hole closure was achieved in all 3 patients at the last follow-up. However, case 1 required a second ATCP surgery due to dislodgement of the plug in the early postoperative period. The BCVA increased in all patients. The final MP analysis revealed that the percentage of fixation points at circles 40 for case 1, case 2 and case 3 were 93.5%, 99.9% and 95.6% respectively. No postoperative serious complications including endophthalmitis, retinal detachment, or proliferative vitreoretinopathy occurred during the follow-up.

Conclusions:

We suggest that the ATCP technique can provide a simple, cheap, repeatable, and readily available surgical solution for the treatment of giant and refractory macular holes. Further prospective studies with a larger sample size are needed to confirm our preliminary results.

Sources:

1. Benson WE, et al. Surgical management of macular holes: a report by the American Academy of Ophthalmology. *Ophthalmology*. 2001;108:1328–1335. doi: 10.1016/s0161-6420(01)00731-x.
2. la Cour M, Friis J. Macular holes: classification, epidemiology, natural history and treatment. *Acta Ophthalmol Scand*. 2002;80:579-587.
3. Kobayashi H, Kobayashi K. Correlation of quantitative three-dimensional measurements of macular hole size with visual acuity after vitrectomy. *Graefes Arch Clin Exp Ophthalmol*. 1999;237:283-288.
4. Michalewska Z, Michalewski J, Adelman RA, Nawrocki J. Inverted internal limiting membrane flap technique for large macular holes. *Ophthalmology*. 2010;117:2018-2025.
5. Chen SN, Yang CM. Lens capsular flap transplantation in the management of refractory macular hole from multiple etiologies. *Retina*. 2016;36:163-170.
6. Grewal DS, Fine HF, Mahmoud TH. Management of challenging macular holes: current concepts and new surgical techniques. *Ophthalmic Sur Lasers Imaging Retina*. 2016;47:508-513.
7. Grewal DS, Mahmoud TH. Autologous neurosensory retinal free flap for closure of refractory myopic macular holes. *JAMA Ophthalmol*. 2016;134:229-230.
8. Hu Z, Lin H, Liang Q, Wu R. Comparing the inverted internal limiting membrane flap with autologous blood technique to internal limiting membrane insertion for the repair of refractory macular hole. *Int Ophthalmol*. 2020 Jan;40(1):141-149.
9. Lytvynchuk LM, Ruban A, Meyer C, Stieger K, Grzybowski A, Richard G. Combination of Inverted ILM Flap Technique and Subretinal Fluid Application Technique for Treatment of Chronic, Persistent and Large Macular Holes. *Ophthalmol Ther*. 2021 Sep;10(3):643-658.
10. Avci R, Mavi Yildiz A, Yilmaz S. Conventional internal limiting membrane peeling versus temporal inverted internal limiting membrane flap for large macular holes. *Eur J Ophthalmol*. 2021;31(2):679-687.
11. Rizzo S, Caporossi T, Tartaro R, Finocchio L, Franco F, Barca F, Giansanti F. A Human Amniotic Membrane Plug to Promote Retinal Breaks Repair and Recurrent Macular Hole Closure. *Retina*. 2019 Oct;39 Suppl 1:S95-S103.
12. Govetto A, Lalane RA 3rd, Sarraf D, Figueroa MS, Hubschman JP. Insights Into Epiretinal Membranes: Presence of Ectopic Inner Foveal Layers and a New Optical Coherence Tomography Staging Scheme. *Am J Ophthalmol*. 2017;175:99-113.
13. Kakizaki H, Takahashi Y, Nakano T, Asamoto K, Ikeda H, Ichinose A, Iwaki M, Selva D, Leibovitch I. Anatomy of Tenons capsule. *Clin Exp Ophthalmol*. 2012 Aug;40(6):611-6.
14. Kate A, Vyas S, Bafna RK, Sharma N, Basu S. Tenon's Patch Graft: A Review of Indications, Surgical Technique, Outcomes and Complications. *Semin Ophthalmol*. 2022;37(4):462-470. doi:10.1080/08820538.2021.2017470
15. Wagdy FM. Tenon Capsule Grafting versus Autologous Scleral Graft in Ahmed Glaucoma Valve

- Surgery. *J Ophthalmol.* 2020;2020:1248023. Published 2020 May 24. doi:10.1155/2020/1248023
16. Mansour HA, Mansour AM. Autologous tenon plug and patch in phacoburn. *BMJ Case Rep.* 2021;14(1):e238970. Published 2021 Jan 20. doi:10.1136/bcr-2020-238970
 17. Yi QY, Wang SS, Gui Q, Chen LS, Li WD. Autologous tenon capsule packing to treat posterior exit wound of penetrating injury: A case report. *World J Clin Cases.* 2021 Jul 6;9(19):5211-5216.
 18. Shimmura S, Shimazaki J, Ohashi Y, Tsubota K. Antiinflammatory effects of amniotic membrane transplantation in ocular surface disorders. *Cornea.* 2001;20:408-413.
 19. Michalewska Z, Michalewski J, Adelman RA, Nawrocki J. Inverted internal limiting membrane flap technique for large MH. *Ophthalmology.* 2010;117(10):2018–2025.
 20. Michalewska Z, Michalewski J, Dulczewska-Cichecka K, Nawrocki J. Inverted internal limiting membrane flap technique for surgical repair of myopic macular holes. *Retina.* 2014;34(4):664–666.
 21. Gekka T, Watanabe A, Ohkuma Y, Arai K, Watanabe T, Tsuzuki A, Tsuneoka H. Pedicle internal limiting membrane transposition flap technique for refractory macular hole. *Ophthalmic Surg Lasers Imaging Retina.* 2015;46(10):1045–1046.
 22. da Silva Tavares Neto JE, Coelho IN, Jorge R, Isaac DLC, de Ávila MP. Pedicle internal limiting membrane flap technique for very large macular holes: a preliminary report. *Int J Retina Vitreous.* 2020 Sep 21;6:43.
 23. Morizane Y, Shiraga F, Kimura S, Hosokawa M, Shiode Y, Kawata T, Hosogi M, Shirakata Y, Okanouchi T. Autologous transplantation of the internal limiting membrane for refractory macular holes. *Am J Ophthalmol.* 2014;157(4):861–869.e1.
 24. Ma FY, Xi RJ, Chen PF, Hao YH. Free autologous internal limiting membrane transplantation in the treatment of large macular hole. *Int J Ophthalmol.* 2019 May 18;12(5):848-851.
 25. Grewal DS, Mahmoud TH. Autologous neurosensory retinal free flap for closure of refractory myopic macular holes. *JAMA Ophthalmol.* 2016;134(2):229-230.
 26. Grewal DS, Charles S, Parolini B, Kadonosono K, Mahmoud TH. Autologous Retinal Transplant for Refractory Macular Holes: Multicenter International Collaborative Study Group. *Ophthalmology.* 2019 Oct;126(10):1399-1408.
 27. Moysidis SN, Koullis N, Adrean SD, et al. Autologous Retinal Transplantation for Primary and Refractory Macular Holes and Macular Hole Retinal Detachments: The Global Consortium. *Ophthalmology.* 2021;128(5):672-685.
 28. Okonkwo ON, Hassan AO, Akanbi T. Autologous Neurosensory Retinal Transplantation: A Report of Three Cases. *J Ophthalmic Vis Res.* 2021 Jan 20;16(1):68-76.
 29. Shields RA, Mahmoud TH. MANAGEMENT OF AUTOLOGOUS RETINAL TRANSPLANT COMPLICATIONS: A CASE SERIES. *Retina.* 2023;43(11):2030-2033.
 30. Rizzo, S. et al. A human amniotic membrane plug to promote retinal breaks repair and recurrent macular hole closure. *Retina* 39(Suppl 1), S95–S103.
 31. Caporossi T, Pacini B, De Angelis L, Barca F, Peiretti E, Rizzo S. Human amniotic membrane to close recurrent, high myopic macular holes in pathologic myopia with axial length OF ≥ 30 mm. *Retina.* 2019; Publish Ahead of Print. doi: 10.1097/IAE.0000000000002699
 32. Caporossi T, Tartaro R, De Angelis L, Pacini B, Rizzo S. A human amniotic membrane plug to repair retinal detachment associated with large macular tear. *Acta Ophthalmol.* 2019;97(8):821–823. doi: 10.1111/aos.14109
 33. Bamberger MD, Felfeli T, Politis M, Mandelcorn ED, Galic IJ, Chen JC. Human Amniotic Membrane Plug for Chronic or Persistent Macular Holes. *Ophthalmol Retina.* 2022