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## Case Report

# Patch Grafting Using an Ologen Collagen Matrix to Manage Tubal Exposure in Glaucoma Tube Shunt Surgery

Masaki Tanito Ichiya Sano Yoshifumi Ikeda Etsuko Fujihara

Division of Ophthalmology, Matsue Red Cross Hospital, Matsue, Japan

## Keywords

Ologen Collagen Matrix · Tubal exposure · Patch graft · Glaucoma tube shunt surgery · Baerveldt glaucoma implant · Ahmed glaucoma valve

## Abstract

**Purpose:** To report the results using an ologen Collagen Matrix as a patch graft in eyes with tubal exposure after tube shunt surgery. **Case Reports:** Case 1 was an 82-year-old man with tubal exposure in his right eye 26 months after receiving a Baerveldt glaucoma implant. The tube was covered by surrounding conjunctival tissue combined with subconjunctival placement of an ologen Collagen Matrix as a patch graft. Two years after implantation, the tube was not exposed. Anterior-segment optical coherence tomography (AS-OCT) showed dense conjunctival tissue over the tube. Case 2 was an 82-year-old man with peripheral keratitis, anterior scleritis, and secondary glaucoma in the right eye who underwent tube shunt surgery using an Ahmed glaucoma valve and cataract surgery. Intraoperatively, scleritis-related scleral thinning prevented the tube from being covered fully by an autologous scleral flap. An ologen Collagen Matrix was placed over the scleral flap as a patch graft. Seventeen months after implantation, the tube was not exposed. Case 3 was a 52-year-old man with diabetic maculopathy and steroid-induced glaucoma in the right eye who underwent tube shunt surgery using an Ahmed glaucoma valve. Intraoperatively, a flap defect prevented the tube from being covered fully by an autologous scleral flap. An ologen Collagen Matrix was placed over the scleral flap as a patch graft. Three weeks postoperatively, AS-OCT showed

thick subconjunctival tissue over the tube. Three months after implantation, the tube was not exposed. **Conclusions:** The ologen Collagen Matrix can be used successfully as a patch graft to prevent and treat tubal exposure after tube shunt surgery.

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## Introduction

Patch graft thinning and conjunctival erosion with exposure of a silicone tube is a complication that occurs in 2–7% of eyes an average of 1.43 years after glaucoma tube shunt surgery [1]. Tubal exposure requires surgical revision or removal of the device to avoid vision-threatening complications such as hypotony and bacterial endophthalmitis [2]. Simple conjunctival closure is inadequate for resolving the exposed tube, and several autograft and allograft materials such as cornea, sclera, fascia lata, buccal mucosa, dura mater, pericardium, and amniotic membrane have been used as patch grafts [3].

The ologen Collagen Matrix (Aeon Astron Europe B.V., Leiden, The Netherlands) is a sponge-like, surgically implantable device that, according to the manufacturer, contains a connected porous structure with a 10- to 300- $\mu\text{m}$  diameter of cross-linked lyophilized porcine type I atelocollagen ( $\geq 90\%$ ) and glycosaminoglycans ( $\leq 10\%$ ). In an animal model, ologen enhanced the closure of conjunctival defects via its role as a three-dimensional scaffold to facilitate cellular migration and proliferation [4]; therefore, the device can be useful to repair conjunctival erosions. We report 1 case of tubal exposure treated with subconjunctival ologen implantation and 2 cases of insufficient tubal coverage by an autologous scleral patch for which ologen served as the primary patch graft.

## Case Reports

Case 1 was an 82-year-old man who presented to our hospital for treatment of increased intraocular pressure (IOP) in his right eye (OD). The best corrected visual acuity (BCVA) and IOP in that eye were 0.15 and 44 mm Hg, respectively, with four antiglaucoma medications. His past surgical history included pars plana vitrectomy and simultaneous cataract surgery for treatment of a rhegmatogenous retinal detachment 2 years before the referral for the increased IOP. He was diagnosed with glaucoma secondary to vitrectomy OD and underwent tube shunt surgery with a Baerveldt glaucoma implant (model BGI 101-350; Abbott, Tokyo, Japan). The plate was placed in the superotemporal quadrant, and the tube was inserted into the vitreous cavity via the pars plana under a half-thickness autologous scleral flap [5]. Two years postoperatively, the BCVA and IOP were between 0.04 and 0.15 and between 6 and 11 mm Hg, respectively, without antiglaucoma medications. Twenty-six months postoperatively, he was referred to our hospital for increased ocular discharge OD. Slit-lamp examination showed the exposed tube between the posterior edge of the autologous scleral flap and the anterior edge of the plate (Fig. 1a). He underwent surgery to cover the tube with the surrounding conjunctiva combined with subconjunctival placement of an ologen Collagen Matrix (model 862051, 12 mm in diameter  $\times$  1 mm thick) as a patch graft (Fig. 1b, c). At the final visit 2 years later, the BCVA and IOP were 0.15 and 9 mm Hg, respectively, without antiglaucoma medications, and the tube was not exposed (Fig. 1d). At this time, anterior-segment optical coherence tomography (AS-OCT) showed dense conjunctival tissue over the tube (Fig. 1e, f).

Case 2 was an 82-year-old man who was referred to a general ophthalmologist for gradually decreasing vision and ocular pain OD. He presented to our hospital 2 days after the referral. The BCVA and IOP in that eye were 0.01 and 34 mm Hg, respectively. Slit-lamp examination showed peripheral corneal infiltrates and ciliary injections OD (Fig. 2a). He was diagnosed with peripheral keratitis, anterior scleritis, and secondary glaucoma of unknown etiology OD; topical steroids and antiglaucoma medication were started. Four days after presentation, he underwent tube shunt surgery to implant an Ahmed glaucoma valve (model AGV FP-7; JFC Sales Plan Co., Ltd., Tokyo, Japan) and simultaneous small incision cataract surgery. The plate was placed in the superotemporal quadrant, and the tube was inserted into the anterior chamber under a partial-thickness autologous scleral flap [5]. Intraoperatively, the tube was not covered fully by the autologous scleral flap due to scleritis-related scleral thinning (Fig. 2b); an ologen Collagen Matrix (model 862051) was placed above the scleral flap as a patch graft (Fig. 2c). At the final visit 17 months after the ologen implantation, the BCVA and IOP were 0.3 and 9 mm Hg, respectively, without antiglaucoma medications, and the tube was not exposed (Fig. 2d).

Case 3 was a 52-year-old man referred to our glaucoma clinic for treatment of increased IOP OD. The BCVA and IOP in that eye were 0.03 and 35 mm Hg, respectively, with three antiglaucoma medications. His past history included pars plana vitrectomy and simultaneous cataract surgery to treat diabetic retinopathy, sub-Tenon injections of triamcinolone acetonide to treat macular edema, and microhook ab interno trabeculotomy [6, 7] to treat steroid-induced glaucoma OD. He underwent tube shunt surgery with implantation of an Ahmed glaucoma valve (model AGV FP-7). The plate was placed in the superotemporal quadrant, and the tube was inserted into the vitreous cavity via the pars plana under a partial-thickness autologous scleral flap [5]. Intraoperatively, the tube was not covered fully by the autologous scleral flap because of a flap defect (Fig. 3a). An ologen Collagen Matrix (model 862051) was placed over the scleral flap as a patch graft (Fig. 3b). Two days postoperatively, a slit-lamp examination showed round material under the conjunctiva (Fig 3c, arrowheads) that became unidentified 2 months postoperatively (Fig. 3d). Three weeks postoperatively, AS-OCT showed thick subconjunctival tissue over the tube (Fig. 3e). At the final visit 3 months after ologen implantation, the BCVA and IOP were 0.04 and 7 mm Hg, respectively, without antiglaucoma medications, and the tube was not exposed.

## Discussion

All of the current cases in which tubes were on the conjunctiva after tube shunt surgery or on the sclera during tube shunt surgery were managed successfully by implantation of ologen before closing the conjunctiva. Previously, ologen had been used as a patch graft to treat 1 case of tubal erosion after implantation of a Baerveldt glaucoma implant [8] and 2 cases of scleral necrosis after pterygium excision [9]. More recently, ologen was used as a primary patch graft in a case series of tube shunt surgeries [10] in which 95.3% of the eyes required no intervention for tubal erosion for an average follow-up period of 32 months. It has been reported that the morphology of filtering blebs after trabeculectomy with adjunctive ologen showed reduced avascularity compared to trabeculectomy with adjunctive mitomycin C [11, 12]. Taken together with previous reports, we confirmed the efficacy of ologen for managing or preventing tubal exposure after tube shunt surgery.

We observed the subconjunctival ologen 3 weeks after implantation (Fig. 3e), but it had disappeared completely, leaving dense conjunctival tissue over the tube by 2 years after

implantation (Fig. 1e, f). According to the manufacturer, the device should degrade completely within 90–180 days, which was supported by our observation. In eyes with bleb leaks after filtration surgery, the avascular blebs typically became more vascularized with a thicker wall as a result of the subconjunctival ologen implantation [13, 14]. When ologen was placed into the subconjunctival space, the histopathologic examination showed that myofibroblasts proliferated randomly and secreted connective tissue in the collagen matrix during the wound-healing process, and the myofibroblasts and vascularization were expected to completely replace the implant in the long term [9, 15]. Accordingly, providing a three-dimensional scaffold to facilitate cellular migration and proliferation was likely the mechanism underlying the efficacy of subconjunctival ologen implantation as a patch graft in the current cases.

We learned from the current cases that the ologen Collagen Matrix can be used as a patch graft to treat and prevent tubal exposure after tube shunt surgery, although the long-term efficacy is unknown. Its availability and the absence of the need for human donors are advantages of ologen over allograft patch materials.

### Statement of Ethics

The patients provided written informed consent for publication of these case reports and the accompanying images.

### Disclosure Statement

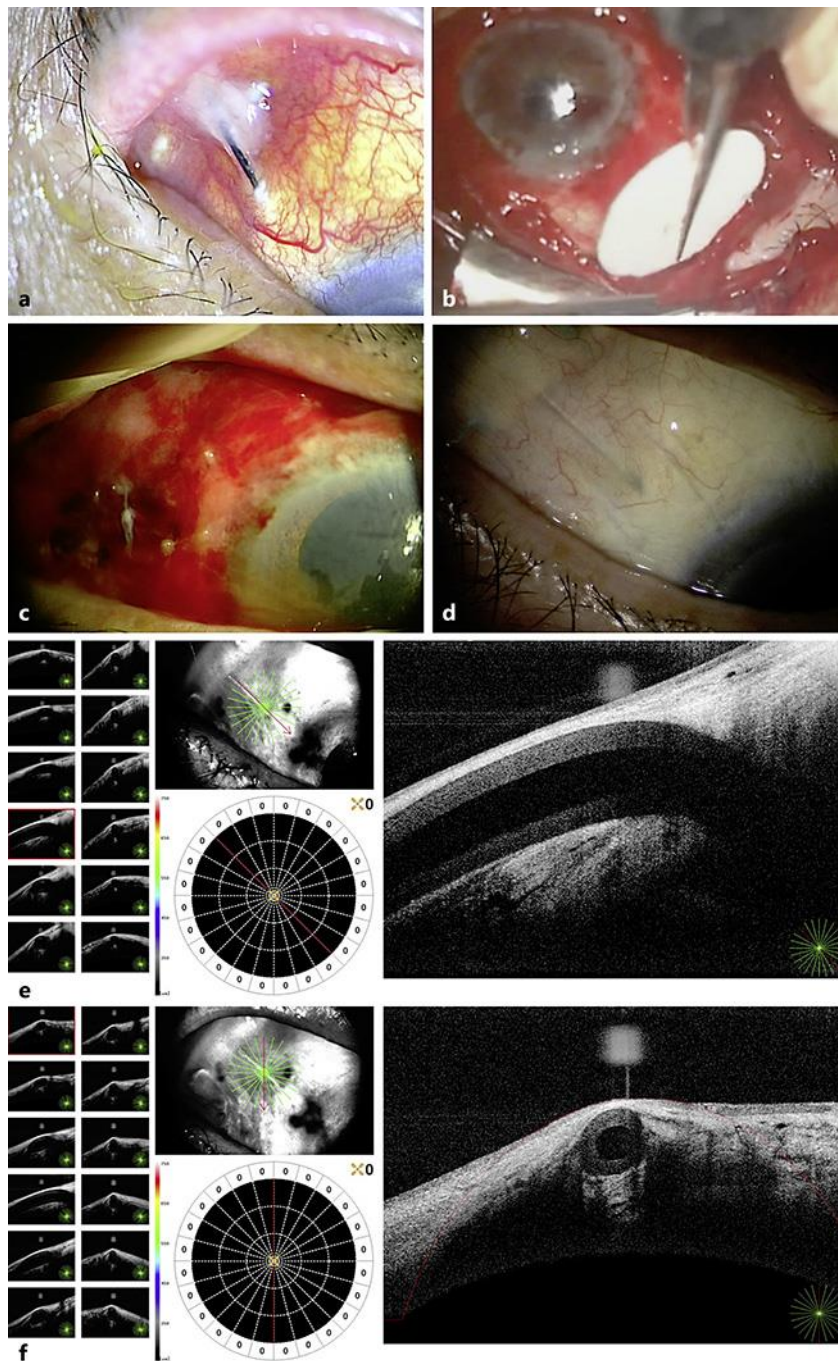
The ologen Collagen Matrix used in this study was provided by Body Organ Biomedical Corporation, Taipei, Taiwan.

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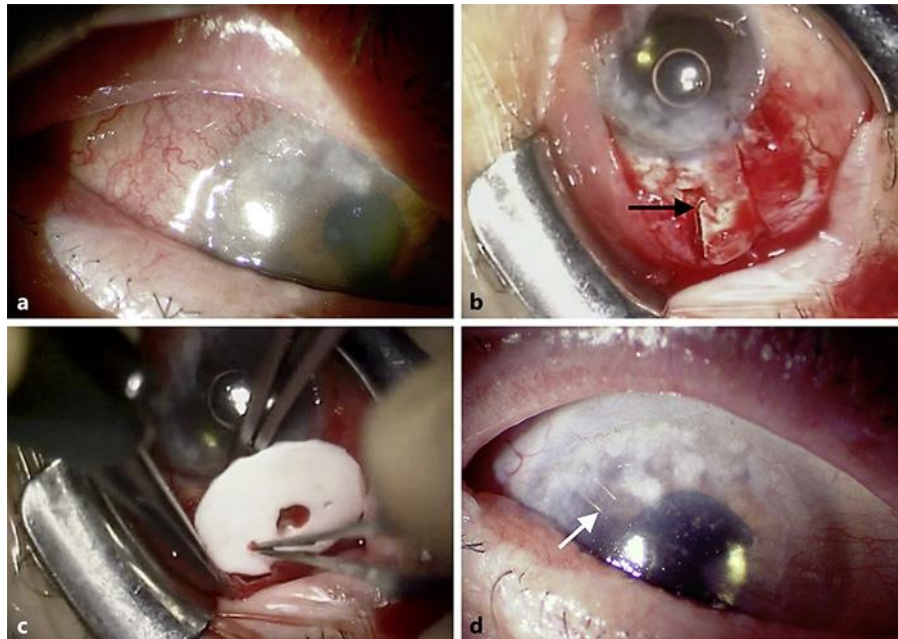
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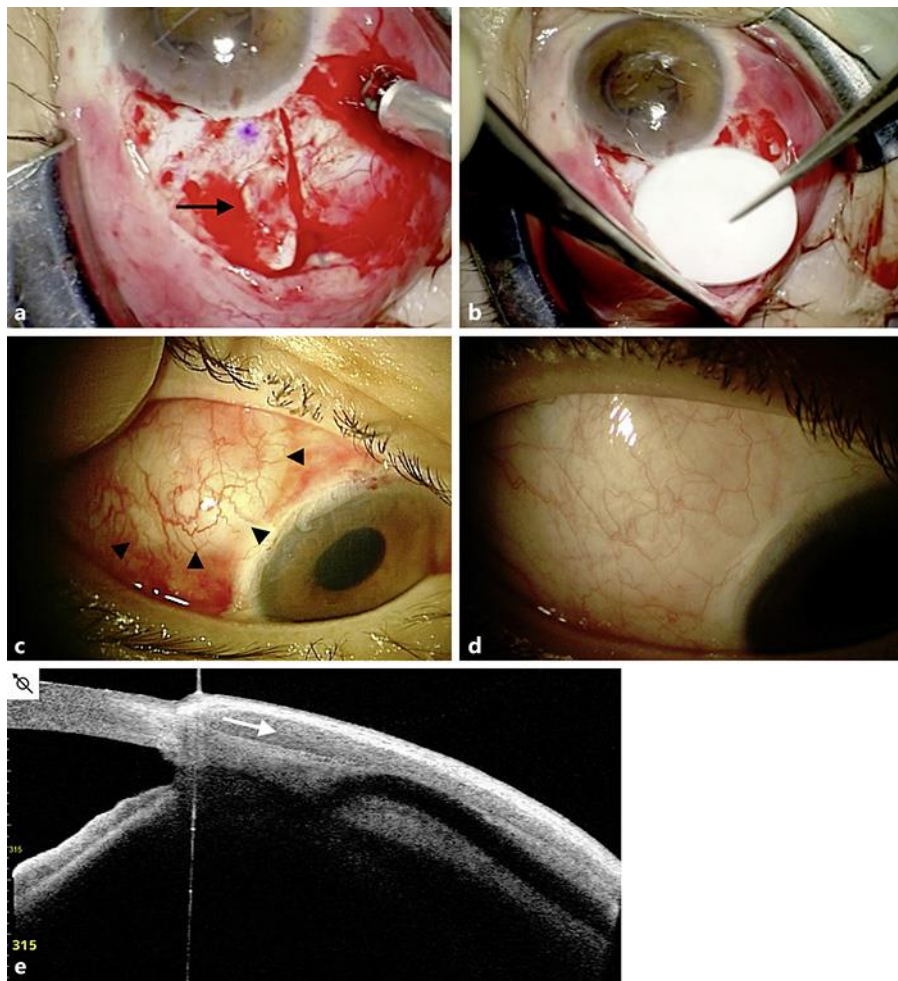
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**Fig. 1.** Case 1. Before ologen implantation, slit-lamp examination shows the exposed Baerveldt tube OD (a). The ologen Collagen Matrix is placed on the tube (b) and the conjunctiva is closed (c). Two years later, slit-lamp examination shows that the tube is not exposed (d); dense conjunctival tissue is seen over the tube by transverse (e) and cross-sectional (f) images of the tube using AS-OCT.



**Fig. 2.** Case 2. At the initial visit, peripheral corneal infiltrates and anterior scleritis are seen OD (**a**). During implantation of the Ahmed glaucoma valve, the tube is not covered fully by the partial autologous scleral flap (**b**, arrow). The ologen Collagen Matrix is placed on the tube as a patch graft (**c**) and the conjunctiva is re-adapted. Seventeen months after the ologen implantation, the position of the tube is excellent (arrow) and the tube is not exposed (**d**).



**Fig. 3.** Case 2. During implantation of an Ahmed glaucoma valve, the tube is not fully covered by a partial autologous scleral flap (**a**, arrow). The ologen Collagen Matrix is placed on the tube as a patch graft (**b**) and the conjunctiva is re-adapted. Two days postoperatively, round material is seen under the conjunctiva (**c**, arrowheads). Two months postoperatively, the material has not been identified (**d**). Three weeks postoperatively, AS-OCT shows thick subconjunctival tissue over the tube (**e**, arrow).