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Vitreoretinal Surgery Using Transconjunctival Sutureless Vitrectomy

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This report presents the effectiveness of 25-gauge Transconjunctival Sutureless Vitrectomy (TSV) for various vitreoretinal disorders. We performed vitreoretinal surgery on 6 patients using 25-gauge TSV. Minimal or no leakage of intraocular fluid or gas was observed at the entry site. No case required a suture to close the conjunctival or scleral opening site, and no complications resulted from the opening site. Median preoperative visual acuity was 0.04 and median postoperative best corrected visual acuity (BCVA) with a mean follow-up of 12 weeks, was 0.45. Median preoperative intraocular pressure was 12.67mmHg, and median intraocular pressure on the first postoperative day was 15.67 mmHg. Because transconjunctival sutureless surgery is minimally invasive, it increases the efficiency of vitrectomy, hastens postoperative recovery, and improves outcomes due to the simplified surgical procedure. We feel that the adoption of the 25-gauge TSV would lead to improved patient comfort, care, and management.

Key Words: TSV(Transconjunctival Sutureless Vitrectomy), microcannula, insertion trocar, aspiration rate, infusion rate

INTRODUCTION

Since pars plana vitrectomy was introduced 30 years ago, the evolution of vitrectomy instrumentation has been driven in part by the desire for smaller instruments and greater functionality.[1-6] The beauty of a smaller gauge vitrectomy instrument system is the possibility of minimize surgically induced trauma at sclerotomy sites, a reduced surgical time, reduced postoperative inflammation, and faster postoperative recovery.[7-14] Moreover, the 25-gauge Transconjunctival Sutureless Vitrectomy (TSV) operating system, allows self-sealing transconjunctival sclerotomies. Sutureless closed vitrectomy is made possible by TSV, obviating conjunctival periotomy.[15-17]

In this report, we present 6 cases of vitreoretinal surgery by 25-gauge TSV, and demonstrate its potential to increase the efficiencies of various vitreoretinal surgeries.

MATERIALS AND METHODS

We retrospectively reviewed 6 eyes of 6 patients who underwent vitrectomy surgery using TSV at the Department of Ophthalmology, Yonsei University College of Medicine.

Cases for surgical intervention included, macular pucker with dense epiretinal membrane after optic neuritis, a traumatic macular hole combined with subretinal hemorrhage, intraocular lens dislocation with vitreous escape, post-capsular opacity after congenital cataract surgery, retinal detachment due to vitreous traction after keratoplasty wound rupture, and aphakia combined with anterior hyaloid opacification. Each patient underwent a detailed preoperative evaluation, including Snellen visual acuity, tonometry, topography, and auto-refraction (Table 1).

A Bausch & Lomb Millennium multisurgery system with TSV-25gauge instrumentation was used throughout. This consisted of a 25-gauge microcannula system, which included a microcannula, an insertion trocar, an infusion cannula,

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Table 1. 25-gauge Transconjunctival Sutureless Vitrectomy System Cases

Age	Sex	Dx	Op.name	Preop V/A	Postop V/A	Final BCVA	Preop IOP (mmHg)	Postop IOP (mmHg)	Preop K-value	Postop K-value	Comments
49	M	M.pucker with	TPPV, total	0.05	0.2(POD#1day)	0.8	14	11	0.50/48	0.25/60	Optic
		dense ERM	Membranectomy		0.4(POD#1mon)			13			neuritis Hx
					0.4(POD#2mon)			22			
					0.5(POD#3mon)			15			
					0.6(POD#4mon)			16			
26	F	Traumatic M.hole	TPPV, total	0.02	HM(POD#1day)	0.02	12	14	1.0/120	0..5/160	Convert to
		with subretinal	ILM removal		0.02(POD#1mon)			12			20G
		hemorrhage	SRF drainage		0.01(POD#2mon)			10			vitrectomy
			TPPV, total		0.02(POD#4mon)			13			
			IOL scleral								
			fixation	0.01	0.2(POD#1day)	0.9	19	17	2.50/126	2.25/136	
68	M	IOL dislocation			0.2(POD#1mon)			17			
		Aphakia	Removal of		0.7(POD#2mon)			14			
			aftercataract		0.7(POD#3mon)			15			
			Vitrectomy,	0.1	0.16(POD#1day)	0.2	12	17	2.25/75	2.25/86	s/p BMR rec
5	M	Aftercataract	anterior		0.16(POD#1mon)			16			
		pseudophakia	TPPV, total		0.16(POD#2mon)			16			
			SE c 3*5mm		0.2(POD#4mon)						
			sponge								
				0.05	HM(POD#1day)	0.16	5	17	7.75/49	6.50/59	s/p PKP
72	F	RD due to vitreous	TPPV, total		HM(POD#1wk)			15			
		traction	2ndary IOL		HM(POD#1mon)			15			
		Aphakia	implantation								
		Aniridia									
				0.01	0.3(POD#1day)	0.6	14	18	2.50/82	1.75/152	foldable IOL
35	M	Aphakia			0.4(POD#1wk)			14			with plate
		s/p ECCE			0.2(POD#2wk)			19			haptics
					0.3(POD#1mon)			19			

BCVA, best corrected visual acuity; BMR, bilateral medial rectus; Dx, diagnosis; ECCE, extracapsular cataract extraction; F, female; HM, hand motion; ILM, internal limiting membrane; IOL, intraocular lens; IOP, intraocular ocular pressure; M, male; PKP, penetrating keratoplasty; RD, retinal detatchment; SE, scleral encircling; SRF, subretinal fluid; TPPV, trans pars plana vitrectomy; V/A, visual acuity.

a plug forceps, a cannula plug, and a wide array of vitreoretinal instruments, including a vitreous cutter, illumination probe, intraocular micro-forceps, a rigid retinal pick, and a tissue manipulator.

Specifically the TSV surgical technique consisted of a cannula transconjunctival insertion using a beveled trocar create a conjunctival and scleral incision measuring 0.5 mm (Fig. 1-A). Three incisions were than made in the inferotemporal, superotemporal, and superonasal quadrants using trocar cannulas. An infusion cannula was inserted into the inferotemporal cannula, and plugs were used to temporarily close entry sites (Fig. 1-B, C, and D).

Specifically, the patient with macular pucker and a dense epiretinal membrane received a core vitrectomy using a 25-gauge vitreous cutter followed by membrane peeling using a 25-gauge microscopic forceps (Fig. 1-E, F). The patient with retinal detachment and multiple holes caused by vitreous traction received vitrectomy, using TSV-

25 system to release retinal traction, and scleral encircling using a 3 * 5 mm sponge (Fig. 2-C).The patient with aphakia underwent vitrectomy and secondary intraocular lens (single piece foldable intraocular lens with plate haptics) insertion using TSV-25 system (Fig. 2-E).

In all procedures except one, surgery was completed by removing the entry site alignment cannulas without conjunctival and scleral suturing (Fig. 1-G). In one case, we had to convert to conventional 20-gauge vitrectomy because of subretinal hemorrhage drain out (Fig. 2-D). The conjunctiva above the sclerotomy was slightly displaced, and disrupted the alignment of sites. A mixture of antibiotics and corticosteroids was injected into the subconjunctival space (Fig. 1-H).

Patients were evaluated postoperatively using the same tests that were used preoperatively. Visual acuity and intraocular pressure were measured on the first postoperative day and during all follow-up visits.

RESULTS

At the end of each procedure, minimal or no leakage of intraocular fluid or gas was observed at entry sites. No case required sutures to close the conjunctival or scleral opening site, and no opening site complication was observed.

Median preoperative visual acuity was 0.04 (range 0.01 - 0.1) and median postoperative best corrected visual acuity (BCVA) with a mean follow-up of 12 wk (range 4 - 16 weeks) was 0.45 (range 0.02 - 0.9). Median preoperative intraocular pressure was 12.67 mmHg (range 5 - 19 mmHg), whereas the median intraocular pressure on the first postoperative day was 15.67 (range 11 - 18 mmHg). Median intraocular pressure was 15.3 mmHg (range 12 - 19 mmHg) at 1 month. In terms of corneal astigmatism, the median preoperative K-value difference was 2.75 (range 0.50 - 7.75), and the median postoperative K-value difference was 2.25 (range 0.25 - 6.50)

In the single case of macular pucker with dense epiretinal membrane after optic neuritis, epiretinal membrane removal was performed successfully (Fig. 1). Visual acuity improved from 0.05 (preoperative) to 0.8 (POD #4month) and corneal astigmatism was reduced by 0.25D (K-value difference), and no complication occurred. In the case of traumatic macular hole with subretinal hemorrhage, we performed vitrectomy and internal limiting membrane peeling using TSV. However, we had to convert to conventional vitrectomy due to subretinal drain out (Fig. 2-D). No change was found between preoperative and postoperative visual acuities during the follow-up. The K-value reduced by 0.5D, and no complication occurred. In the case of intraocular lens dislocation with exposed vitreous, we performed vitrectomy and intraocular lens scleral fixation using TSV (Fig. 2-B). Visual acuity improved from 0.01 (preoperative) to 0.2 (POD#1) and to 0.9 at 2 months after operation. The K-value change over the same 9-month period was 0.25D. In the case of post-capsular opacity after congenital cataract surgery, the after-cataract was removed and anterior vitrectomy using TSV performed (Fig. 2-A). TSV was particularly appropriate for this case because it was compatible with a small pediatric eyeball. All of these procedures were easier to perform than conventional vitrectomy. Visual acuity improved from 0.1 (preoperative) to 0.2 (POD# 4month) with no K-value change, and no complication was observed during the follow- up period. In the case of retinal detachment caused by vitreous traction after KP wound rupture, scleral encircling was performed with a 3 * 5 mm sponge and this was followed by vitrectomy using TSV to release vitreous traction that was not relieved by the scleral encircling alone (Fig. 2-C). We were able to reattach the retina successfully. Visual acuity improved from 0.05 (preoperative) to 0.16 (POD#1month). As this patient had a history of keratoplasty, we examined the corneal endothelial count using a specular microscope. The preoperative cell density was 548 whereas the postoperative cell density was 512. In addition, the K-value reduced by 1.0D. In the case of aphakia with anterior hyaloid opacification, wevitrectomy and secondary intraocular lens implantation (foldable intraocular lens with plate haptics) were administered using TSV (Fig. 2-E). Visual acuity improved from 0.01 (preoperative) to 0.6 (POD# 1 mon), and the K-value reduced by 0.75D. In all the cases, intraocular pressure change pre-to postoperatively was minimal.

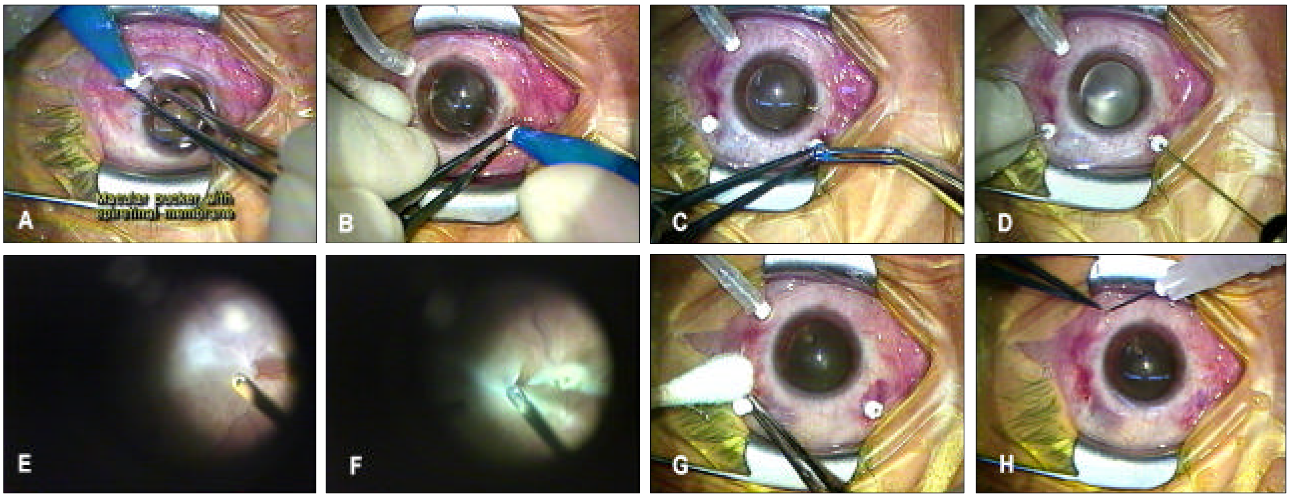

Fig. 1. Photographs of surgery in case 1- the patient presented with a macular pucker and an epiretinal membrane. (A) Placement of the first microcannula. The microcannula is being held by its collar to stabilize it while the trocar is withdrawn. (B) An infusion cannula has been placed in the inferotemporal quadrant. In the same frame, a second microcannula is being placed. (C) After insertion of the second microcannula, its orifice was temporarily closed with a plug and a third microcannula was inserted. (D) a three-ports transconjunctival vitrectomy system with infusion and instruments was prepared. (E, F) An epiretinal membrane was noted at the macula and membrane peeled off. (G) After vitrectomy and membrane peel, the microcannula was simply removed. H, After removing the microcannulas, a subconjuctival injection was administered.

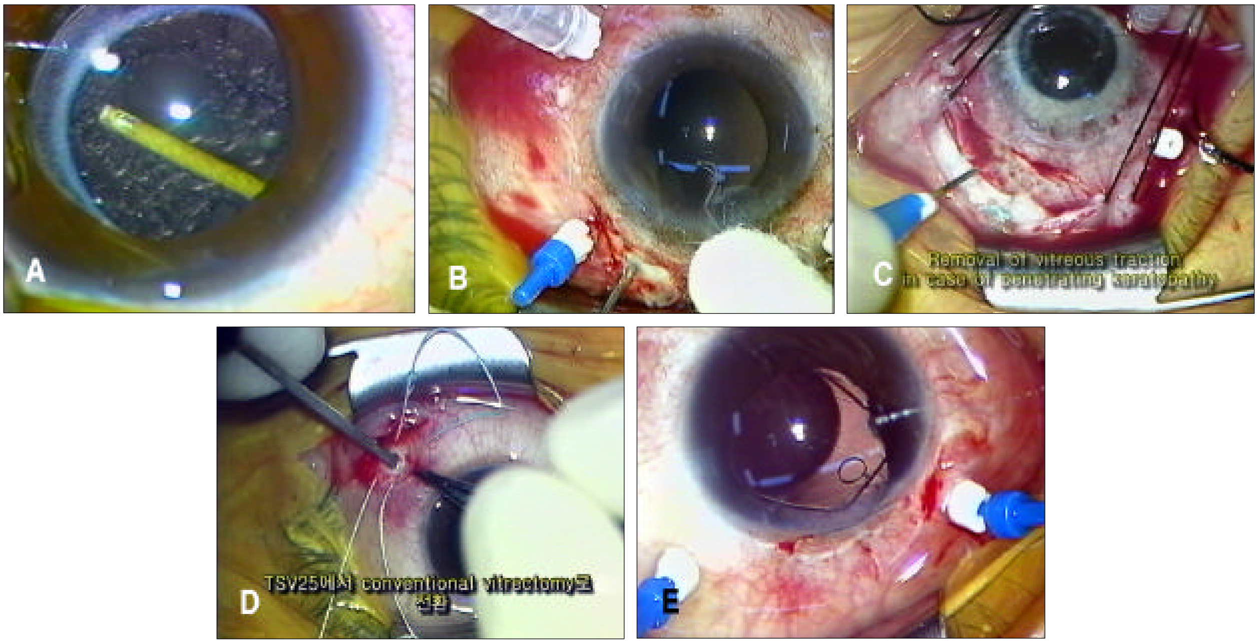

Fig. 2. Photographs of case surgeries- using a Transconjunctival Sutureless Vitrectomy System. (A) In the case of post-capsular opacity after congenital cataract surgery, we removed the after-cataract and performed anterior vitrectomy. (B) In the case of intraocular lens dislocation with exposed vitreous, we performed vitrectomy and intraocular lens scleral fixation. (C) In the case of retinal detachment caused by vitreous traction after KP wound rupture, we performed scleral encircling with a 3*5 mm sponge and vitrectomy using TSV to release vitreous traction that was not completely relieved by scleral encircling. (D) In the case of a traumatic macular hole with subretinal hemorrhage, we performed vitrectomy and internal limiting membrane peeling by TSV. However, we had to convert to conventional vitrectomy due to subretinal drain out. (E) In the case of aphakia with anterior hyaloid opacification, we performed vitrectomy and secondary intraocular lens implantation (foldable intraocular lens with plate haptics).

DISCUSSION

All the procedures were performed using TSV without scleral or conjunctival suturing. We also observed that the immediate postoperative external appearance was significantly less traumatic for TSV than by conventional vitrectomy.[12,14-16]

There are several advantages of TSV versus conventional conjunctival and scleral incisions; reduced surgical time, less postoperative inflammatory response, less postoperative astigmatism, and a faster postoperative recovery.[7-9] In addition, TSV also reduces postoperative discomfort from suture irritation.[17]

In our cases, we found TSV a useful supportive tool for releasing vitreous traction not relieved by scleral buckling alone for retinal detachment, and consider this procedure an effective, minimally invasive, supportive tool for scleral bucking. Another benefit of TSV is its effectiveness in children. In the pediatric case in our study, which was a case of post-capsular opacity removal after congenital cataract surgery, we observed that for reasons of size TSV was more compatible with the child's eyeball. TSV also allowed the surgeon greater flexibility and comfort when working inside the small eyes of children.[7]

The follow-up period was rather short in the present study. However, the achieved ollow-up duration was deemed long enough to evaluate the intraoperative effectiveness of TSV and the occurrence of surgically related complications during the immediate postoperative period.

Despite the effectiveness of this new system, it has several problems; aspiration is limited; back flush manipulation is less effective (because the diameter of the vitrectomy probe is small); it is poor at enduring fine instruments; and its use is limited to several instruments, (because there is no reusable back flush needle, only a disposable back flush needle without a soft tip can be used, and there is a lack of laser instrumentation). Because of these shortfalls, in one case we had to convert to conventional vitrectomy to drain subretinal hemorrhage.

TSV requires some modifications that are specifically related to its smaller size, as the aspiration flow is significantly lower than for a conventional 20-gauge vitrectomy system. Therefore, in order to use the 25-gauge vitreous cutter, maximum aspiration rate must be maintained to achieve optimal fragmentation of the intraocular tissue so as not to occlude the cannula with aspirated material. We set the BSS bottle height at 40cm, and the infusion rate at 0.09 ml/second at a maximum aspiration setting of 500 mmHg for the Millennium system. In this way, we secured a safety margin against hypotony during aspiration.

We are of the conclusion that the 25-gauge TSV system is a highly effective practical option for various vitreoretinal surgeries. The minimally invasive nature of TSV increases the efficiency of vitrectomy surgery, hastens postoperative recovery, and improves outcomes by simplifying the surgical procedure. The strengths of TSV include reduction in surgically induced trauma, recovery time, operating time, and postoperative inflammatory response. We believe that the 25-gauge TSV system will improve patient comfort, care, and management.

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