·Clinical Research·

High speed small gauge anterior vitrectomy cutter for scleral fixated intraocular lens implantation

Yuan Bo Liang[1], *Yoly Y.Y. Fong*[2], *Lulu L. Cheng*[2], *Alvin L. Young*[2]

[1]Clinical and Epidemiological Eye Research Center, the Affiliated Eye Hospital, School of Optometry and Ophthalmology, Wenzhou Medical University, Wenzhou 325027, Zhejiang Province, China

[2]Department of Ophthalmology & Visual Sciences, the Chinese University of Hong Kong, Prince of Wales Hospital, Shatin, Hong Kong, China

Correspondence to: Alvin L. Young. Department of Ophthalmology & Visual Sciences, the Chinese University of Hong Kong, Prince of Wales Hospital, Shatin, Hong Kong, China. youngla@ha.org.hk

Received: 2016-03-19 Accepted: 2016-09-26

Abstract

● **AIM: To report the outcomes of anterior vitrectomy using high speed cutter for scleral fixated intraocular lens (SFIOL) implantation in patients with posterior capsular rupture.**

● **METHODS: Medical records of 51 patients with posterior capsular rupture who received high speed cutter anterior vitrectomy *via* limbal incision with SFIOL implantation from June 2011 to December 2013 were reviewed retrospectively for visual outcomes and complications.**

● **RESULTS: Totally 51 eyes of 51 patients were identified (23 males and 28 females). Mean age at surgery was 67.2±15y (range 27-91y), with mean follow-up of 23±8.2mo (range 12-40mo). The 49 (96.1%) eyes had improvement or unchanged of final postoperative visual acuity. The most common complication was vitreous haemorrhage (5.9%) and transient rise in intraocular pressure (5.9%) which all spontaneously resolved**

● **CONCLUSION: High speed cutter anterior vitrectomy *via* limbal incision is a safe and effective method for those with posterior capsular rupture for SFIOL implantation.**

● **KEYWORDS:** cataract; aphakia; posterior capsular rupture; intraocular lens; scleral fixation

DOI:10.18240/ijo.2017.01.13

Liang YB, Fong YY, Cheng LL, Young AL. High speed small gauge anterior vitrectomy cutter for scleral fixated intraocular lens implantation. *Int J Ophthalmol* 2017;10(1):77-80

INTRODUCTION

Scleral fixated intraocular lenses (SFIOL) have provided encouraging results for the management of aphakia with inadequate capsular support[1]. Anterior vitrectomy is usually needed to remove vitreous from the anterior chamber and entry incisions to prevent adhesions which may transmit traction to the retina[2]. For vitreous removal, the cut rate should be set high with low to moderate aspiration to enable vitreous to flow continuously into the cutter to reduce traction on the retina[3]. Previous anterior vitrectomy machines provided only 800 cuts per minute with a 20-gauge cutter. Newer anterior vitrectomy machines provide faster cutting rates. Theoretically, a faster cutter would have less disturbance of posterior vitreous body providing good stability of the anterior chamber[4].

Shimada *et al*[5] reported three cases using bimanual anterior vitrectomy with 25-gauge high speed cutter for managing vitreous loss during phacoemulsification, allowing sharp excision of vitreous and reducing vitreous traction during excision. The purpose of our study was to evaluate the outcomes of patients who received anterior vitrectomy with a 23-gauge high speed cutter together with SFIOL implantation.

SUBJECTS AND METHODS

The medical records of patients who underwent anterior vitrectomy with a 23-gauge high speed cutter (2500 cuts per minute) and SFIOL implantation in our university teaching hospital were analyzed retrospectively. The study reviewed the records of patients who underwent surgery from June 2011 to December 2013 with a minimum follow-up of 1y. Institutional ethics approval was not required for this study.

Data including age, sex, pre-existing ocular conditions, indications for surgery, preoperative visual acuity and postoperative best spectacle-corrected visual acuity (BSCVA) and refractive outcome by automated or clinical refraction, surgical history and postoperative complications were collected and analyzed.

The operation involved lateral conjunctival pockets and superior peritomy. The center of cornea was marked and SFIOL needle site was marked 2 millimeters behind the limbus and 2 millimeters apart. A superior scleral tunnel wound was prepared without entry. Paracentesis was performed at 2 or 3 o'clock region. Scleral tunnel wound was only opened after the completion of bimanual anterior vitrectomy[6-7]. Bimanual anterior vitrectomy was performed by the INFINITI® Vision System (Alcon Laboratories, Inc. USA) with 2500 cuts per minute by a 23-gauge probe through limbal paracentesis wound.

SRK-T formula was used to calculate the power of the lens implant. Alcon CZ70BD (Alcon Laboratories, Fort Worth, Texas, USA) intraocular lens were used for all SFIOL implantations. The ab externo method was used in all cases for placing the scleral passes. The 10-0 polypropylene sutures were used for transscleral fixation of lens haptics, 10-0 nylon was used for wound closure and 8-0 polyglactin sutures were used for conjunctival closure.

Statistical Analysis The Snellen BSCVA was converted into logarithm of the minimum angle of resolution (logMAR) units for statistical analysis. We used a value of 1/400 Snellen (logMAR=2.6) to represent vision of counting fingers and used extrapolated values of 2.7, 2.8, and 2.9 logMAR to represent hand movement, light perception, and no light perception, respectively. The paired *t*-test was used to analyse of preoperative and postoperative visual acuity. The critical value of significance was set at $P<0.05$. Analysis was carried out using SPSS V.19.0 (SPSS, Chicago, Illinois, USA).

RESULTS

For this study, 51 eyes (29 right eyes and 22 left eyes) from 51 patients (23 males and 28 females) were identified. All patients had at least 12mo of follow-up, with a mean of 23±8.2mo and median of 22mo. Average age was 67.2±15y and range was 21 to 91y. The preoperative characteristics and demographic details are summarized in Table 1.

Eighteen (35.3%) eyes had primary SFIOL with anterior vitrectomy. Indications were due to capsular rupture with inadequate capsular support or zonulysis with vitreous loss encountered during extracapuslar cataract extraction in 5 eyes (9.8%), intracapsular cataract extraction in lens subluxation in traumatized eyes or associated with ocular or systemic disease in 7 eyes (13.7%). Less common indications were removal of subluxed intraocular lens in 4 eyes (7.8%), and 2 cases (3.9%) with removal of intraocular lens and penetrating keratoplasty together with anterior vitrectomy and SFIOL due to corneal decompensation after previous anterior chamber intraocular lens implantation. Thirty-three (64.7%) eyes received secondary SFIOL with anterior vitrectomy after being left aphakic after capsular rupture during cataract extraction (n=25, 49.0%) or had a history of previous trauma or open globe injury (n=8, 15.7%) with which were left aphakic after primary lens removal. The mean BSCVA was 1.19±0.75 logMAR (range 0.02 to 2.80) units preoperatively and 0.51±0.69 logMAR (range -0.97 to 2.90) units postoperatively. The mean difference between final postoperative and preoperative visual acuity was 0.68±0.80 logMAR units (95% CI 0.45 to 0.90; $P<0.0001$), which was statistically significant. Overall, forty-seven (92.2%) of patients had improved final postoperative visual acuity, two (3.9%) with unchanged postoperative visual acuity, and two (3.9%) had reduced visual acuity compared to preoperative measurement.

Table 1 Preoperative characteristics $\bar{x} \pm s$ (range)

Parameters	Number	Percentage (%)
Age (a)	67.2±15 (27-91)	-
Follow-up duration (mo)	23±8.2 (12-40)	-
Right/Left	29/22	56.9/43.1
Female/Male	28/23	54.9/45.1
Pre-existing ocular conditions		
Glaucoma	10	19.6
Macular scar	2	3.9
Epiretinal membrane	2	3.9
Ambylopia	2	3.9
Fuch's dystrophy	2	3.9
Retinitis pigmentosa	1	2.0
Traumatic optic neuropathy	1	2.0
Operation received		
AV+primary SFIOL	18	35.3
ECCE	5	9.8
ICCE	7	13.7
Removal of subluxed IOL	4	7.8
Removal of IOL+PKP	2	3.9
AV+secondary SFIOL	33	64.7

AV: Anterior vitrectomy; SFIOL: Scleral fixated intraocular lens; IOL: Intraocular lens; ECCE: Extracapsular cataract extraction; ICCE: Intracapsular cataract extraction; PKP: Penetrating keratoplasty.

One eye had postoperative visual loss with deterioration of visual acuity from light perception to no perception of light. This patient had history of traumatic optic neuropathy 20y ago after blunt trauma. Preoperatively the patient had exotropia, relative afferent pupillary defect and a dense cataract subluxed superotemporally with no fundal view. B-scan preoperatively was unremarkable. The patient received intracapsular cataract extraction with primary anterior vitrectomy and SFIOL implantation. Postoperative fundus exam showing pale optic disc, mild vitreous hemorrhage which resolved spontaneously, otherwise unremarkable fundi examination. A possible mechanism in deterioration in visual acuity could be due to undiagnosed postoperative intraocular spikes that could potentially inflict further insult to an already damaged optic nerve. Another eye had postoperative visual loss from 0.70 to 2.70 logMAR units, due to retinal detachment after anterior vitrectomy and secondary SFIOL implantation, which redetached and required a second retinal detachment operation. Two eyes had stable visual acuity, including one eye with chronic angle closure glaucoma (CACG) with end stage disc cupping and history of intracapsular cataract extraction with secondary SFIOL implantation and anterior vitrectomy performed. There was persistent elevation in intraocular pressure (IOP) of over 21 mm Hg requiring escalation of anti-glaucomatous eye drops, but did not require further surgical intervention to control the IOP. Visual acuity remained stable and there was no progression on Humphrey visual field. One eye had pre-existing epiretinal membrane and had stable visual acuity after SFIOL implantation and anterior vitrectomy, and the patient was not keen for further surgical intervention.

Postoperative complications are shown on Table 2. The most common complications was vitreous hemorrhage (5.9%) which all spontaneously resolved without sequelae and transient elevation of IOP (5.9%) which were all managed with escalation of eyedrops. There was one case of glaucoma progression which was managed with escalation of eyedrops without requiring glaucoma surgery. There was one case of IOL tilt and one with mild decentration of IOL, but there were no cases of IOL dislocation. Two eyes had peaked pupil postoperatively, one due to iris being chewed intraoperatively which did not affect visual acuity and no further complications were reported and one due to residual vitreous in anterior chamber. There was one eye with refractive surprise and tolerated spectacles. No patients suffered from postoperative choroidal detachment, cystoid macula edema or corneal decompensation.

Table 2 Complications of anterior vitrectomy and SFIOL implantation

Complications	No. of eyes (%)
Vitreous haemorrhage	3 (5.9)
Transient elevation in intraocular pressure	3 (5.9)
IOL tilt/decentration	2 (3.9)
Peaked pupil	2 (3.9)
Glaucoma progression	1 (2.0)
Retinal detachment	1 (2.0)
Epiretinal membrane	1 (2.0)
Refractive surprise	1 (2.0)
Vitreous remnant in anterior chamber	1 (2.0)
Endophthalmitis	0
Corneal decompensation	0
Cystoid macula edema	0

DISCUSSION

The incidence of posterior capsular rupture (PCR) is estimated to be between 0.45% and 7.9%, across different levels of surgical experience[1]. PCR can result in vitreous prolapse into the anterior chamber, which can lead to vitreous traction on the retina leading to retinal tears and detachment or cystoid macula edema. Proper management by anterior vitrectomy can reduce morbidity to the patient. Careful inspection of the anatomy of the capsule and zonules is required to determine the appropriate site for IOL implantation. SFIOL have provided encouraging results for the management of aphakia with inadequate capsular support[1].

In this study, the results of SFIOL with anterior vitrectomy with the faster cutting rate vitrectomy machine have been encouraging. Although our study includes a relatively small sample number, we have a follow up of almost two years and observed relatively low rate of complications regarding to the high speed anterior vitrectomy performed with SFIOL.

There was only one (2.0%) case of retinal detachment in our study which is relatively low compared to previous report rate of 8% in patients who received SFIOL[8]. A low rate of retinal detachment or retinal tears can be achieved due the high speed cutting action during vitreous removal, resulting in less traction during excision[5,9-10]. Another goal during anterior vitrectomy is to maintain as stable IOP as hypotony can result in complications such as suprachoroidal hemorrhage and cystoid macula edema. These complications did not occur in our series, which could be due to the high speed cutter effect that helps maintain a stable IOP. Other complications also occurred at a relatively low rate compared to previous studies on SFIOL. Chan *et al*[11] reported a vitreous hemorrhage rate of 12.2% and transient IOP rise of 10.8% after secondary SFIOL.

Anterior vitrectomy can be performed through an incision at the limbus or pars plana. Some advocate a pars plana approach to minimise anterior chamber manipulation and permit the removal of vitreous well behind the posterior capsule, which is more difficult when the cutter is introduced through the anterior chamber. We generally prefer to introduce the instrument through a limbal incision as it is less invasive than creating additional sclerotomies for pars plana vitrectomy which also avoids the possibility of inducing retinal dialysis and hypotony[5,12-18]. The additional advantages of such small gauge cutter is the better maintanence of IOP during vitrectomy, thus minimise the risk of introoperative hyptotony often encountered in SFIOL situations.

In this case series the incidence of complications of anterior vitrectomy with SFIOL implantation is low. There have only been limited studies discussing about bimanual anterior vitrectomy using high speed vitrectomy cutter. Shimada *et al*[5] also discussed about a similar surgical method in a case report using bimanual anterior vitrectomy with 25-gauge high speed cutter. However, only three cases were reported the study without long-term follow-up results.

Limitations of this study are its retrospective and single-centre nature, relative small case numbers, variable preoperative ocular history and time of anterior vitrectomy performed. Further studies will be desirabe on the comparision between high speed and low speed cutters for anterior vitrectomy and their outcomes. Nevertheless, anterior vitrectomy with a high speed cutter for SFIOL implantation for cases complicated by posterior capsular rupture is a safe with low complication rates.

ACKNOWLEDGEMENTS

Conflicts of Interest: Liang YB, None; **Fong YY,** None; **Cheng LL,** None; **Young AL,** None.

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