

Sulcus Transscleral Intraocular Lens Suture Fixation through Small Scleral Tunnel Incision

Wenjie Wu, Qing Li, Duan Yan, Jianhui Zhang, Yi Chen, Huiying Zhang
Fujian Provincial Hospital, Fuzhou 350001, China

Abstract

Purpose: To evaluate the clinical efficacy and safety of sulcus transscleral intraocular lens suture fixation with small incision through scleral tunnel in eyes with posterior capsule defect or insufficient zonula support.

Methods: Thirty nine eyes with severe posterior capsule defect and zonula damages caused by small-incision cataract surgery, and those with capsule absence or intraocular lens dislocation were selected in this investigation from February 2007 to December 2009. Sulcus transscleral intraocular lens suture combined with puncture needle-guided external approach and “one- or two-point fixation” method in the small sclera tunnel incision were employed.

Results: The mean follow-up was 12.1 months (range from 3 to 28 months). Six eyes were complicated by some eye diseases postoperatively. The best-corrected visual acuity was 20/40 or better in other 34 eyes (87.17%). All eyes with secondary IOL fixation presented equal or better naked visual acuity than best-corrected visual acuity best-corrected preoperatively. No intraoperative and postoperative complications such as hemorrhage, retinal detachment, intraocular lens tilt and decentration occurred.

Conclusion: Sulcus transscleral intraocular lens suture fixation via small sclera tunnel incision was easy to operate and master, required less operative time, and made primary intraocular lens fixation more effective in eyes with posterior capsule defect or insufficient zonula support in small sclera tunnel incision surgery. In addition, the technique was safe and efficacious for secondary intraocular lens fixation. (*Eye Science* 2011;26:103–108)

Keywords: Small scleral tunnel incision; Intraocular lens; Suture fixation

Small incision non-phacoemulsification cataract surgery is gradually becoming the major surgical option for large-scale and grassroots cataract surgery because of its particular advantages and better post-operative outcome. But the complications of capsule absence or insufficient zonula support are still a huge challenge encountered by cataract surgeons. Sulcus transscleral of intraocular lens is becoming the optimal option for the aphakia patients or whose eyes with insufficient capsule support to regain their visual acuity because intraocular lens is fixed in its physiological location and long-term stability of corneal endothelium is better in this surgery. The traditional single-loop or double-loop sulcus fixation of intraocular lens require re-create the scleral flap and suture, cost more time, require more surgery technique and difficult to achieve primary fixation¹⁻². A total of 39 eyes underwent sulcus transscleral intraocular lens suture fixation through small scleral tunnel incision in our hospital and during cataract project from February 2007 to December 2009 were recruited. All patients yielded satisfied outcome. The surgery is simple, easy to master and to achieve primary suture with short operative time. Herein the case was reported as below.

Materials and Methods

General information

A total of 39 eyes, 22 males and 17 females, mean aged 61.7 years old (range from 32 to 81 years old) were recruited. Totally 26 patients presenting with posterior capsule defects in more than two quadrants, 3 patients whose zonula was transected more than one quadrant, 1 patient with dislocated intraocular lens. Twenty five of 39 eyes developed posterior capsule defect and insufficient zonula caused by non-

Foundation item: Science and technology project of Fujian Province (2008F3031)

DOI: 10.3969/g.issn.1000-4432.2011.02.0010

Corresponding author: Wenjie Wu, E-mail: wuwenjie1740@yahoo.com.cn

phacoemulsification cataract extraction. Intraocular lens suture and fixation was performed in primary surgery. Thirteen eyes suffered from posterior capsule defect during cataract surgery or vitreous surgery. Secondary sulcus transsclera intraocular lens sutured in small sclera tunnel incision was conducted. One eye experienced intraocular lens dislocation following cataract surgery with intraocular lens implantation and then the dislocated intraocular lens were extracted through small sclera tunnel incision and re-sutured. Intraocular lens were fixed with single-loop or double-loop according to the status of posterior capsule and zonula lesion. Twenty three among 39 eyes adopted 'one-point fixation' and the remaining 16 eyes adopted 'two-point fixation'. The mean follow-up was 12.1 months (range from 3 to 28 months).

Surgical approach

The eyes were fully dilated with compound tropicamide, post-eyeball anesthesia under 2% lidocaine and surface anesthesia under 0.5% proparacaine hydrochloride. Surgery process was fulfilled under microscope, sutures were fixed on inferior rectus, '–' shaped-sclera tunnel was incised with a distance of 2.0 mm from corneal limbus. The incision was about 6 mm in width and 1/2 sclera in thickness, separated to 1.5 mm from transparent cornea, expanded the sclera tunnel incision and cut the inner opening about 7–8 mm. The dual-plane limbus tunnel auxiliary incision was made by 3.0 mm gauge keratome in direction 10, the length was 1.5 to 2.0 mm. ①Small incision non-phacoemulsification cataract surgery: injected viscoelastic agents to anterior chamber from auxiliary incision in direction 10, then continuous circular capsulorhexis and water separation and stratification of lens was made, rotated the lens nuclear to anterior chamber in sclera tunnel incision, injected viscoelastic agents to front and rear of lens nuclear, extracted the lens, cut off the prolapsed vitreous body with the capsule scissors for the patients with vitreous prolapse due to insufficient capsule or zonula support. ②Dislocated intraocular lens were extracted: injected viscoelastic agents were injected into the front and rear of dislocated intraocular lens, stretched the iris restorer to the rear end of intraocular lens in the auxiliary incision in direction 10 and

then stretched microscopic toothed forceps in the sclera tunnel incision to separate intraocular lens and the surrounding adhesion tissue, then the intraocular lens were extracted from sclera tunnel incision and cut off the prolapsed vitreous.

Fixation of single-loop intraocular lens in small sclera tunnel incision

Raised the sclera flap in sclera tunnel incision gently with microscopic forceps, then inserted a needle of 1ml gauge syringe vertically into the eyeball under sclera flap or sclera tunnel from 1.5 mm behind of limbus usually on direction 12 or direction close to the incision deflection according to the status of posterior capsule and zonula lesion. Adjusted the direction of 1 ml gauge needle to opposite the lateral incision, stretched the polypropylene 10–0 gauge long-needle in the lateral incision, pulled out the needle after sending the syringe tube into eyeball, then passed the polypropylene suture through the sclera tunnel (Figure 1). Pulled the polypropylene suture out from sclera tunnel and ligated with the central intraocular lens loop tightly. Implanted intraocular lens into the ciliary sulcus in sclera tunnel incision, tensioned the polypropylene suture of upper loop and then ligated the polypropylene suture with the needle carrying few tissues around the sclera, covered the suture knot by super sclera flap, kept the sclera flap non-suture or by only 1 needle according to the self-close status of sclera flap.

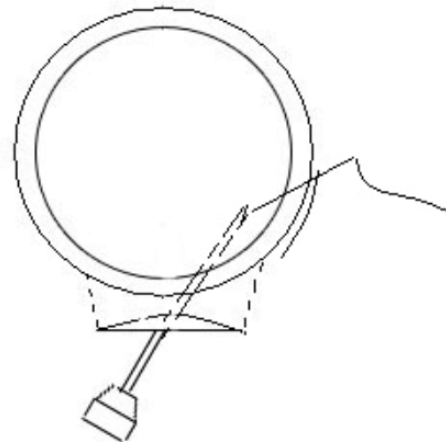


Figure.1

Sulcus of double-loop intraocular lens in small sclera tunnel incision

A small incision was cut on the conjunctiva to ex-

pose sclera on direction 6, constructed a triangle sclera flap based with limbus whose thickness was about 1/2 of cornea 1–3 mm apart from limbus. Raised the sclera flap in sclera tunnel incision gently with microscope tweezers, inserted a 1ml needle vertically into the eyeball in the tunnel under sclera flap 1.5 mm behind the limbus. Held the 1 ml needle gently with left hand, inserted a 10–0 gauge polypropylene long-needle 1.5 mm apart from limbus under sclera flap on direction 6 with right hand, pulled out the syringe after sending the needle with polypropylene thread into the 1ml needle tube, and passed the polypropylene suture through the sclera tunnel (Figure 2). Pulled out the polypropylene thread in eyeball and cut off in the centre, ligated the upper and lower ends to the centre of upper and lower loop of intraocular lens tightly respectively. Implanted the intraocular lens to ciliary sulcus in the sclera tunnel incision, tensioned the polypropylene suture in upper and lower loop and then ligated the polypropylene suture with the needle carrying few tissues surrounding the sclera, sutured 1 needle in the lower sclera flap with 10–0 gauge nylon thread, covered the upper polypropylene suture knot by upper sclera flap safely, kept the sclera flap non-suture or by 1 needle alone according to the self-closure status of sclera flap.

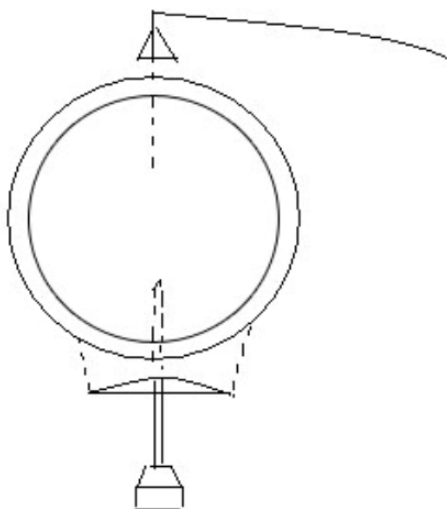


Figure.2

Results

Postoperative visual acuity

Thirty-four eyes (87.17%) acquired postoperative

best corrected visual acuity ≥ 0.5 , 2 eyes (5.12%) were 0.3–0.5, 3 eyes (7.69%) were < 0.3 . Of the 5 eyes had corrected visual acuity < 0.5 , 2 eyes were proliferative diabetic retinopathy, 2 eyes were leukoma, 1 eye was optic atrophy. Postoperative uncorrected visual acuity in eyes with secondary intraocular lens implantation was equal to or more than preoperative best corrected visual acuity.

Intraoperative or postoperative complications

No intraoperative complications such as hemorrhage or iris injury occurred. Two of 39 eyes (1 eye with original intraocular lens dislocation) developed mild anterior uveitis whose inflammation was controlled after topical or systemic therapy with corticosteroid, 3 eyes developed transient increased intraocular pressure at day 1 after operation whose IOP was normal after topical IOP-reducing treatment, 1 eye developed postoperative cystoid macular edema which was resolved by OCT after microcirculation treatment. No visible polypropylene thread-ends were discovered. No evident intraocular lens dislocation, tilt and eccentricity or flare was reported during follow-up.

Discussion

Scleral transscleral suture fixation of posterior chamber intraocular lens proposed and applied by Girard in 1981, has gradually matured accompanied by improved microsurgery technique. It has been safely applied to treat severe complication of posterior capsule defect and insufficient zonula support in children and adult patients³. Although anterior chamber intraocular lens implantation and sulcus trans-iris of posterior chamber intraocular lens remain effective surgical options for treating patients with severe post capsule and zonula lesion, and the modern anterior chamber intraocular lens reduced the incidence of complication by modified new design of open-loop, the potential complication with anterior chamber intraocular lens including long-term corneal endothelial decompensation, secondary glaucoma, cystoid macula edema and interference optical aberrations (e. g. optical enlargement, anisometropia, lens shaking, marginality flare) still prevents its extensive application⁴, and the application with anterior chamber intraocular lens should be extremely cautious to

the elderly patients with relatively limited counts of corneal endothelial cells. The sulcus trans-iris of intraocular lens requires more skillful surgical techniques and lack of long-term follow-up results. Sulcus of posterior chamber intraocular lens allows the intraocular lens to approach the physiological location of lens and optical node, exerts low impact upon corneal endothelium, iris and anterior chamber angle. In addition, the positional mechanical barrier can prevent vitreous body from moving forward and inhibit the distribution of vasoactive substances thus reduce the incidence of retinal detachment and cystoids macular edema. Based upon the collective merits, it has become a preferential surgical option for cataract surgeons^{2,4,5,6,8}.

The combined application of sulcus posterior chamber intraocular lens suture fixation in small sclera tunnel incision with puncture needle-guided external approach employed in this study not only resolves the complications due to posterior capsule defect affecting more than 2 quadrants and lacking zonula support greater than 90 degree in small incision non-phacoemulsification surgery to achieve the primary intraocular lens implantation in small incision surgery, but also displays unique advantages in secondary IOL sulcus. ①The primary intraocular lens implantation in small incision cataract surgery: when the severe complications with posterior capsule and zonula occurred, traditional sulcus of IOL need to re-construct a flap in lamellar sclera, further prolong operative time, increase the surgery difficulty in hypotension eyes due to partial removal of vitreous body. Complicated procedure will increase the incidence of intraoperative and postoperative complications. Previous study by Althaus C et al⁷ suggested that in the hypotension eyes the external approach could avoid the occurrence of eyeball collapse, target the position more accurately, regain visual more quickly and experience less complications postoperatively compared with internal approach. After removing prolapsed vitreous during surgery, the polypropylene thread used for sulcus of intraocular lens passed through the preset upper small incision sclera flap guided with external approach, which simplified the surgery procedure evidently, avoided the potential damage to ciliary artery rings (on direc-

tion 3 or 9), and shortened the surgery duration significantly. The surgical skill was easy to master either in 'one-point' or 'two-point' sulcus. The primary intraocular lens implantation assisted the patients with severe posterior capsule and zonula damages induced during small incision operation to achieve better visual acuity recovery and effectively reduce the incidence of complications including further prolapsed vitreous, delayed incision healing, keratopathy, retinal detachment and endophthalmitis. The primary intraocular lens implantation more benefited the elderly patients from remote and poor areas who had limited access to follow-up in large-scale surgical prevention of blindness. ②The sulcus of intraocular lens in small sclera tunnel incision was a safe and simple method for secondary intraocular lens implantation: Young AL et al⁶ reported that the eyeball collapse was considered as a tough problem encountered in sulcus transsclera of intraocular lens, the upper sclera tunnel had a long span (starting from 2 mm behind limbus to a distance of 1.5 mm near transparent cornea), showed excellent self-closing capability, therefore effectively avoided the occurrence of eyeball collapse during operation. Previous study by Young AL also demonstrated that compared with traditional monoplane sclera or corneal incision, the sclera tunnel incision could more stably maintain the anterior chamber, prevent subsequent prolapse of vitreous body and more effectively keep the IOP at a stable level when the intraocular lens were sutured or surgical instruments were inserted or pulled out of the eyes. The excellent self-closing of long sclera tunnel was able to cause no incision when implanting the rigid IOL, effectively reduce the incidence of postoperative astigmatism and achieve visual acuity recovery at early postoperative stage. The desirable self-closure of sclera tunnel, coverage of polypropylene knot by sclera and upper conjunctiva, the simple surgery procedure and the short operative time can reduce the potential incidence of postoperative endophthalmitis. The longest follow-up time of the study lasted 28 months. No patients experienced endophthalmitis or polypropylene knot exposure.

Hannush SB⁸ reported that intraoperative haemorrhage and postoperative intraocular lens tilt and dis-

location were regarded as the severe intraoperative and postoperative complications in sulcus transsclera of intraocular lens. No patients experienced intraoperative hemorrhage, evident tilt and eccentricity of IOL during the follow-up. The obtained experiences from this study were summarized as follows: ①Utilization of sclera flap guarantees more stable anterior chamber. ②The application of puncture needle-guided external approach: previous study by Hannush SB showed that external approach located the ciliary sulcus more accurately, less complications such as intraoperative haemorrhage, tilt and eccentricity of IOL occurred, and the incidence of postoperative astigmatism, pupil deformation and cystoid macular edema were lower compared with internal approach. ③Choosing the 1 ml gauge needle: its characteristics including easy availability, sharp needle tip, small puncture, well-matched inner diameter and lock the polypropylene long-needle exactly could further reduce the incidence of intraoperative hemorrhage. ④Short surgical time and simple operation significantly reduced the intraoperative hemorrhage and promoted fast recovery of visual acuity after surgery⁴. ⑤Utilization of rigid intraocular lens: sulcus of foldable intraocular lens possessed the advantages of smaller incision, less postoperative astigmatism and faster recovery after surgery. But Oh HS et al found tilt or eccentricity complications were more inclined to occurring after sulcus of foldable intraocular lens due to the soft texture of foldable intraocular lens³. Implanting the rigid intraocular lens in small sclera tunnel incision induced small incision and required no sulcus of foldable intraocular lens, which effectively averted the disadvantages presented by soft intraocular lens. The optimal option was 'C' type loop or double-loop hole suspension-specific intraocular lens in transsclera sulcus when applicable, because it could further reduce the incidence of tilt and eccentricity. The most severe long-term complication in sulcus transsclera of intraocular lens fixation was intraocular lens dislocation due to long-term intraocular lens polypropylene thread transaction⁸. Buckley EG⁹ reported that the mean time of polypropylene thread transection after sulcus was 8.5 years. He also found that the intraocular lens dislocation caused no damage to intraocular

tissues such as retina. In addition, the visual acuity recovered to previous level after relocation and sulcus. Compared with the long-term complication of corneal endothelial decompensation with anterior chamber intraocular lens, the complication of polypropylene thread transection was reversible and curable. Multiple techniques including suitable suture knots with polypropylene, full coverage by sclera flap overlapping the line knot, embedding the polypropylene thread within the sclera using embedded method, choosing the 9-0 polypropylene suture, are able to further reduce and prevent the transection of polypropylene suture fixation⁹.

The severe complications presented by posterior capsule defect and insufficient zonular support are commonly encountered by all cataract surgeons along with the large-scale cataract surgery during the past few years. In conclusion, it is important for cataract surgeons to master the sulcus transsclera of posterior chamber intraocular lens. The sulcus of intraocular lens in small sclera tunnel incision combined with puncture needle-guided external approach can curtail operative time and reduce the incidence of complications. Along with its simple and easy procedure, it can be applied as a safe and efficacious treatment of severe zonular lesions and posterior capsule defects in either primary or secondary sulcus of intraocular lens.

References

- 1 Zhai DY, Luo SY, Yang AM. The experience of 6 patients with intraocular lens suspension. *Chinese Journal of Ocular Trauma and Occupational Eye Disease*, 2006, 28: 393-395.
- 2 Du LL, Liang D, Huang H, He W. Observation of posterior chamber IOL suture fixation in 42 patients (43 eyes). *Chinese Journal of Practical Ophthalmology*, 2005, 23: 749-751.
- 3 Oh HS, Chu YK, Kwon OW. Surgical technique for suture fixation of a single-piece hydrophilic acrylic intraocular lens in the absence of capsule support. *J Cataract Refract Surg*, 2007, 33: 962-965.
- 4 Chen SX, Lee LR, Sii, MBBS F. Modified cow-hitch suture fixation of transscleral sutured posterior chamber intraocular lenses: Long-term safety and efficacy. *J Cataract Refract Surg*, 2008, 34: 452-458.
- 5 Li GL, Li HT. Fixation and observation of PCIOL implantation when posterior capsule of lens defected.

- Contemporary Medicine, 2009, 15: 6–7.
- 6 Young AL, Leung GYS, Cheng LL, Lam DSC. A modified technique of sclera fixated intraocular lenses for aphakic correction. *Eye*, 2005, 19, 19–22.
- 7 Althaus C, Sundmacher R. Intraoperative intraocular endoscopy in transscleral suture fixation of posterior chamber lenses: consequences for suture technique, implantation procedure, and choice of PCL design. *Refract Corneal Surg*, 1993, 9: 333–339.
- 8 Hannush SB. Sutured posterior chamber intraocular lenses; indications and procedure. *Current Opinion in Ophthalmology*, 2000, 11: 233–240.
- 9 Buckley EG. Safety of transscleral-sutured intraocular lenses in children. *J AAPOS*, 2008, 12: 431–439.