ORİJİNAL ARAŞTIRMA ORIGINAL RESEARCH

DOI: 10.5336/ophthal.2016-53611

Scleral Fixated Posterior Chamber Intraocular Lens for Children with Traumatic Cataract

Travmatik Kataraktlı Çocuklarda Sklera Fiksasyonlu Arka Kamara Göz İçi Merceği

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Geliş Tarihi/*Received:* 15.10.2016
Kabul Tarihi/*Accepted:* 17.01.2017

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ABSTRACT Objective: To report on the outcomes of posterior chamber lens implantation with scleral fixation (SFIOL) in children with traumatic cataract after 1 year. **Material and Methods:** Eleven eyes of eleven cases were included in the study. All patients had corneal or corneoscleral lacerations that were primarily repaired except one patient. Traumatic cataract subsequently developed and SFIOL was performed due to insufficient posterior capsule support. Pre-operative and post-operative best corrected visual acuity (BCVA), intraocular pressure (IOP), intraocular lens (IOL) position, anterior chamber reaction, and retinal evaluation were analyzed via retrospective medical record review. **Results:** From 2013-2015, 11 SFIOLs were implanted in 11 children with traumatic cataracts. The average age of the patients was 8.2 years (range: 5 to 14 years). All cases had SFIOL implanted via internal route using triangular double scleral flaps made of 10-0 polypropylene after a complete anterior vitrectomy. Average follow-up was 16.57±3.41 months (range: 12 to 26 months). Visual acuity was increased at the last visit in all patients ($p<0.05$). Common postoperative complications were fibrinous reaction in 5 (46%) patients, vitreous hemorrhage in 4 (36%) patients, and transient intraocular pressure increase in 2 (18%) patients. Results showed no evidence of complications after the postoperative first year. **Conclusion:** SFIOL is an effective and reliable method in patients with pediatric traumatic cataract who had insufficient posterior capsule support who are lacking other means for visual rehabilitation.

Keywords: Lenses, intraocular; cataract

ÖZET Amaç: Travmatik kataraktlı çocuklarda skleral fiksasyon tekniği ile arka kamaraya göz içi lensi (SFGİL) implantasyonunun 1 yıl sonrası sonuçlarını değerlendirmek. **Gereç ve Yöntemler:** Çalışmaya onbir pediatrik olgunun onbir gözü dâhil edildi. Öncesinde bir hasta dışındaki tüm hastalarda mevcut olan kornea veya korneoskleral laserasyon tamir edildi. Sonradan gelişen travmatik katarakt hastalarına arka kapsül desteğinin yetersiz olması nedeni ile SFGİL uygulandı. Ameliyat öncesi ve ameliyat sonrası geriye dönük tıbbi kayıtların gözden geçirilmesi ile en iyi düzeltilmiş görme keskinliği (EİDGK), göz içi basıncı (GİB), göz içi lens (GİL) pozisyonu, ön kamara reaksiyonu ve retina bulguları değerlendirildi. **Bulgular:** 2013-2015 yılları arasında, 11 travmatik kataraktlı çocuğa 11 SFGİL yerleştirildi. Hastaların ortalama yaşı 8.2 yıl (5 ile 14 yıl arası) idi. Tüm olgulara tam bir ön vitrektomi sonrası üçgen çift skleral flep olusturularak ve 10-0 polipropilen kullanılarak SFGİL implante edildi. Ortalama izlem 16.57 ± 3.41 ay (12-26 ay arası) idi. Görme keskinliğinde tüm hastalarda son kontrolde artış saptandı ($p<0.05$). Ortak erken postoperatif komplikasyonlar: 5 (%46) hastada fibrin reaksiyonu, 4 (%36) hastada vitreus hemorajisi ve 2 (%18) hastada geçici göz içi basıncı artışı idi. Postoperatif 1 yılın sonunda komplikasyona rastlanmadı. **Sonuç:** Yetersiz posterior kapsül desteği bulunan travmatik kataraktlı çocukların optik rehabilitasyonunda skleral fiksasyonlu sekonder GİL uygulaması etkili bir yöntemdir.

Anahtar Kelimeler: Lensler, göz içi; katarakt

Ocular trauma is a leading cause of blindness and low vision constituting the second most reason for preventable low vision following ambliyopia in pediatric patients.[1] 20-50% of all ocular traumas are seen in pediatric age.[2] Traumatic cataract is an early or late complication of

ocular trauma. It is caused commonly by penetrating or blunt traumas; however, it may also be rarely caused by electrical, chemical, extreme hot or cold shock traumas, ionizing or nonionizing radiation.[3] Due to the difficulties in obtaining accurate keratometry and axial length measurements, timing of the implantation, and intraocular lens (IOL) placement in cases with inadequate capsular support, management of traumatic cataract is different from routine cataract surgery. Also, managing traumatic cataracts in children requires attention to the type of lens, and the IOL calculation when implanting an IOL.[4]

Fixating of the IOL in the capsule is the most reliable and preferred technique because of the advantages such as separation of IOL from uveal tract, decreased pigment dispersion and providing a stable blood aqueous barrier. However, in cases of the absence of capsular or zonular support, or large defects in iris tissue, most of IOLs are placed into posterior chamber and sutured to the sclera through the ciliary sulcus or pars plana. The aim of this study was to estimate the visual outcomes and safety of secondary posterior chamber IOL implantation-a scleral fixation technique- in children with deficient posterior capsule support due to trauma after 1 year.

MATERIAL AND METHODS

Medical records of 11 eyes of 11 pediatric patients between February 2013 and December 2015 who underwent lens removal and a scleral fixation of IOL (SFIOL) implantation (due to inadequate capsular support) with or without corneal/corneoscleral tear repair through an anterior approach were analyzed retrospectively. The study protocol was approved by the Institutional Review Board/Ethics Committee and was performed in accordance with the tenets of the Declaration of Helsinki.

Patient's history of immunization against tetanus was evaluated. A tetanus shot was given if there was incomplete or uncertain history of recent immunization. Ciprofloxacin 0.3% and cyclopentolate hydrochloride 1% were applied to the patient with blunt trauma and systemic prophylactic endophthalmitis treatment (cefazolin 25-50 mg/kg/day) was applied to all ocular trauma patients. All the patients received at least 5 days of prophylactic intravenous cefazolin.

All of the eyes were assessed in terms of glob integrity, posterior segment pathology and intraocular foreign body before the surgery. The patients with posterior segment pathology, intraocular foreign body and corneal pathologies which may affect the visual prognosis were excluded from the study. IOL power was calculated using SRK-T formula in partial coherence interferometer device (AL Scan, Nidek, Japan-2012). The eye exposed to trauma was used to get measurements if the glob integrity was sustained. If the glob integrity was broken down, then the measurements were obtained from the other nontraumatized eye in the absence of anisometropia or strabismus. IOL power selections were modified according to the charts by age.[5] All the surgeries were performed by a single surgeon (YK). Postoperative examinations were performed at one day, one week, one month, three months, six months and at one year. Pre-operative and post-operative best corrected visual acuity (BCVA) in Snellen visual acuity charts, intraocular pressure (IOP) (with non-contact tonometer), IOL position (with anterior segment optical coherence tomography), anterior chamber reaction (with slit lamp microscopy), and retinal evaluation at their last follow-up were analyzed via retrospective medical record review. Immediate and late postoperative complications were also evaluated (Figure 1).

SURGICAL PROCEDURE

All the surgeries were performed under general anesthesia. Corneal/corneoscleral tear was repaired using 10-0 nylon interrupted sutures. The conjunctiva was dissected 180' apart from each other in the horizontal quadrant. Limbus based 3x3 mm triangle shaped scleral flap was created. A wide clear corneal incision was made to enter anterior chamber. Lens was removed from the incision. Polymetacrilate (PMMA) scleral fixating IOL was implanted to all of the patients. Anterior vitrectomy was performed to all of the cases. Double-armed 10/0 prolene suture was passed through the

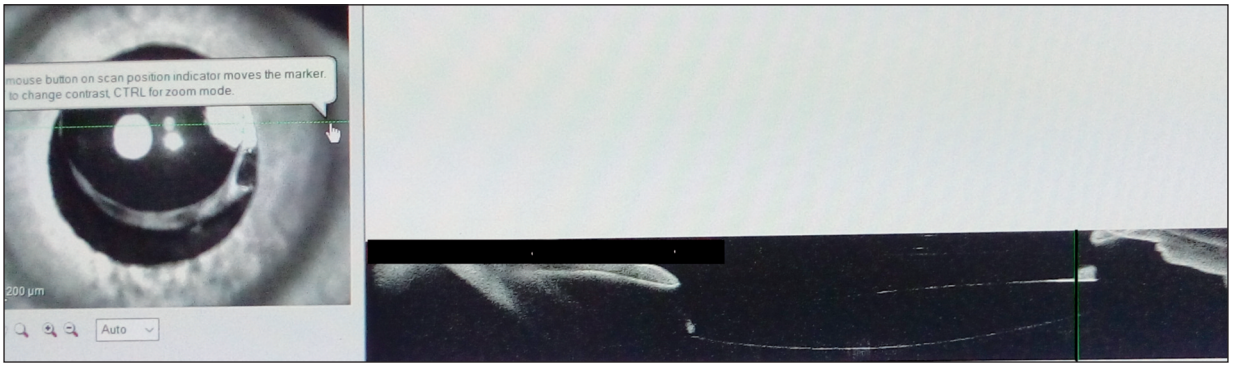

FIGURE 1: Anterior segment optic coherence tomography analysis of intraocular lens position.

vitreous cavity under the scleral flap and exit the eye in the guidance of 26 G PPD needle passed in the opposite site. Then the suture was placed outside the eye and cut in the middle. Each site of the suture was knotted to the haptics of the IOL. After ensuring the IOL is placed centrally the sutures were fixated to the sclera. Scleral flap was closed with 8/0 vicryl suture and conjunctiva was closed with 7/0 vicryl suture. Postoperative tobramycin-dexamethasone drops were applied every two hours while the patient was awake, for one week, and were tapered as the patient's condition permitted. Cyclopentolate hydrochloride 1% drops were instilled twice daily for the first two postoperative weeks.

Data were collected on postoperative BCVA, IOP, fundus details, and complications at each follow-up visit.

STATISTICAL ANALYSIS

The Student's t-test (two-tailed and dependent) was used to determine the significance of study parameters on a continuous scale. Statistical analysis was performed using SPSS software, version 20 (IBM, Armonk, New York, USA). All values were expressed as mean values ± standard deviation and results for categorical measurements are presented as a number (%). A *P* value less than 0.05 was considered significant.

RESULTS

Eleven patients with traumatic cataract secondary to ocular trauma were included in this retrospective study. The mean age of the patients was 8.2 (range 5-14) years. Of the patients 8 (72.7%) were male and 3 (27.3%) were female. In terms of the causes of the ocular traumas, playgrounds constitutes the most frequent cause with 6 patients (54.5%) followed by home accidents with 4 patients (36.4%). The most frequent ways of the ocular traumas were hit by stick or stone. All of the cases were unilateral. One patient had blunt ocular trauma and 10 patients had penetrating ocular trauma.

Medical treatment (prednisolone acetate 1% eyedrops and ciprofloxacin 0.3% eyedrops six times a day tapered over 2 months, cyclopentolate hydrochloride 1% twice a day for 2 weeks) was applied to the patient with blunt trauma without any primary surgical repair. As fibrous reaction and hyphema resolved, cataract extraction and IOL implantation was performed immediately. Primary surgical repair was performed to the patients with penetrating trauma within 24 hours of the injury. The mean time between injury and operation was 9.30 ± 5.41 hours. Of the 10 patients who had undergone primary surgical repair 3 had corneascleral penetration, 7 had corneal penetration. All of the patients were operated within the first 24 hours of ocular trauma in order to achieve glob integrity.

In follow-up, 8 patients had traumatic cataract on the right eye and 3 on the left eye. Five patients had mature cataract, 4 patients had absorbed cataract and 2 patients had subluxated cataract. Reason for scleral postoperation complication IOL (PCIOL) fixation included lack of lens capsule due to extensive capsular rupture and/or zonulolysis. The mean time between primary surgical repair

TABLE 1: Pediatric scleral fixated IOLs: patient data.

Patient	Etiology of Trauma	Age (year)	Cataract Type	BCVA (preop)	BCVA (postop 1- year)	Amblyopia Treatment	Follow-up (month)
1	Blunt	9	Mature	PL	4/10	+	18.4
2	Penetrating	5	Absorbed	HM	4/10	+	13.1
3	Penetrating	5	Absorbed	CF	6/10	+	17.3
4	Penetrating	5	Mature	PL	1/10	+	15.8
5	Penetrating	6	Subluxated	HM	7/10	+	14.2
6	Penetrating	7	Mature	HM	2/10	+	18.2
7	Penetrating	8	Mature	PL	7/10	+	16.7
8	Penetrating	10	Absorbed	CF	8/10	+	15.9
9	Penetrating	10	Subluxated	HM	4/10	+	19.9
10	Penetrating	12	Absorbed	HM	9/10	None	17.7
11	Penetrating	13	Mature	CF	3/10	None	14.3

BCVA: Best corrected visual acuity; CF:Countıng fingers; HM: Hand motion; PL: Light perception.

and cataract extraction and IOL surgery was 5.9 ± 3.4 (2-16) weeks. One piece PMMA was used in all of the surgeries. Mean postoperative follow-up was 16.5 ± 3.4 months, ranging from 12 months to 26 months.

BCVA was hand motions in 4 patients, counting fingers in 3 patients and perception of light in 4 patients preoperatively. At 1st year follow up the mean BCVA was 0.5 ± 0.4 Snellen lines ($p<0.05$) (Table 1). In total, 50% of our patients achieved a visual acuity of 6/12 or better. The cause of poor visual acuity included corneal scaring in 4 patients, macular scar in one patient, and amblyopia in one patient.

At one year follow-up visit the mean spherical refraction was -1.2 ± 1.5 (-5 to 0,5) D and the mean cylinderic refraction was -3.5 ± 1.7 (-6,5 to 0) D. High corneal astigmatism has seen in patients with corneal scarring. As early postoperative complications 4 patients (36.4%) had fibrinous anterior chamber reaction, 1 patient (9.1%) had dense membrane formation, 4 patients (36.4%) had vitreous hemorrhage and 2 patients (18.2%) had transient IOP elevation. These patients were followed with medical treatment and do not require any further surgical treatment. At the last follow up visit the mean IOP values was 13.3 ± 3.9 mmHg and none of the patients had secondary glaucoma. Results showed no evidence of endophthalmitis, suture exposure, suture breakage, IOL tilt, hypotony, iris capture of the IOL optic, retinal detachment or choroidal effusion.

DISCUSSION

Traumatic cataracts occurring in pediatric age not only decrease visual acuity but also cause amblyopia, strabismus and nystagmus by inhibiting visual development in this critical period which cortical visual processes continue to maturate. Early intervention and visual rehabilitation is essential in order to improve visual results in this critical period.[6] Various techniques have been used in the children with ocular trauma, including aphakic spectacles, contact lens. However, IOL implantation after cataract removal is the best way to prevent amblyopia. In traumatic patients lens extraction and IOL implantation simultaneously with primary surgical repair has some drawbacks beyond the advantages such as early visual improvement. These complications include corneal endothelial damage, lens removal without cataract formation and inflammation triggered by the cataract surgery.[7] BCVA was evaluated between primary and secondary surgery and there was no significant difference between them.[8] With the results of the previous studies we first performed primary surgical repair of the penetration and controlled the acutely formed inflammatory response. We performed

cataract extraction and IOL implantation after a mean duration of 5.9 ± 3.4 weeks.

Due to the difficulties in stabilization of the IOL, anterior chamber IOL or scleral fixating IOL implantations are the alternative procedures in cases of the ocular traumas in which capsular support is absent or not sufficient. In contrast to the implantation of a scleral fixated lens, the implantation of an anterior chamber lens is a time saving surgery and the operation technique is much easier. However, anterior chamber lens implantation may result in severe endothelial cell loss followed by corneal decompensation, uveitis, cystoid edema, distorted pupil, and secondary glaucoma or pupillary block.[9,10] Although bullous keratopathy and iridocorneal angle damage are less frequent with new generation anterior chamber IOLs, these complications limit the use of these IOLs in pediatric age with long time expectancy especially because of the possible hazardous effects on central endothelial cell density.[7,11] Posterior chamber IOL implantation causes less damage to cornea, iris and iridocorneal angle structures theoretically. The location of the SFIOL is closer to the nodal point and has lower risk for pseudophacodonesis, inflammation and corneal endothelial decompensation compared with the anterior chamber IOLs. Therefore the complications which are frequent with anterior chamber IOL implantation are seen less highly.[12,13] The sclera-sutured posterior chamber lens implantation has also some disadvantages. In addition to early complications, such as vitreous bleeding, choroidal hemorrhage, and initial intraocular pressure fluctuation, the main risks are retinal detachment and chronic macular edema which might be caused by vitreous traction.[8,12]

Zou et al. showed that scleral fixation of PMMA IOL had similar effect in terms of postop BCVA compared with foldable IOL in children.[14] Scleral fixating IOL implantation can be performed with various techniques. Frequently preferred surgical technique is knotting the suture underneath the scleral flap thus preventing the exposure of the suture. The main complications of the surgery include vitreous hemorrhage, hyphema, suprachoroidal hemorrhage, choroidal effusion, cystoid macular edema, retinal detachment, pigment dispersion, infection, glaucoma, pupillary involvement, IOL decentralization and dislocation.[15,16]

In our study the most frequent early complication was fibrinous reaction in anterior chamber (4 patients, 36.4%). In one patient (9.1%) membrane formation in the pupillary space was occurred. In our patients medically treated anterior chamber reaction following SFIOL surgery (45.5%) was more frequent than the previous studies with pediatric population (11.1%, 18.2%).[17,18] This difference may be attributed to the pediatric age and relatively long duration of the surgery. Ocular traumas trigger inflammation. Iritis or fibrin reaction was found to be twice in patients who had undergone cataract extraction and IOL implantation in the second intervention compared with the patients who had undergone cataract extraction and IOL implantation in the first intervention.[19] Additionally fibrinous reaction is seen less frequently in adult patients compared to the pediatric group of patients.[20] Previous studies reported frequency of fibrinous reaction in children with traumatic cataract ranging from 21% to 100%.[4]

Another early postoperative complication vitreous hemorrhage is reported 1-52% in the literature in pediatric patients who had undergone SFIOL surgery.[15,21] In our study we encountered this complication in 36.4% of the patients. Contrary to expectations this frequency was similar to those children who did not experienced ocular trauma. This may be explained with the location of the scleral flap and scleral sutures being far from the ciliary arteries and vascular ciliary body. 18.2% of the patients had postoperative high IOP levels and this was similar with the previous studies.[15,17,21] The patients with high IOP levels were treated successfully and none of the patients developed refractory glaucoma. None of the patients had suture erosion, irritation and endophthalmitis. Covering the sutures well with scleral flaps is important in order not to encounter these complications.

Scleral fixating IOL implantation is an efficient surgery in optic rehabilitation of the children with

traumatic cataract with insufficient capsular support. Our study demonstrates that good postoperative visual acuity can be achieved if the posterior segment is not involved and corneal scar does not block the vision. Further studies with large number of patients and long follow up period comparing the different techniques and IOL types are needed to enhance the results of this surgery.

Conflict of Interest

Authors declared no conflict of interest or financial support.

Authorship Contributions

Yaran Koban conducted the literature search and composed the manuscript. Yaran Koban and Orhan Ayar conceived the idea for the manuscript, and critiqued the manuscript. Yaran Koban and Orhan Ayar carried out the patients interaction and diagnosis, and final approval of the manuscript. All authors read and approved the final manuscript.

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