

Scleral-Sutured Posterior Chamber Intraocular Lens Implantation in Children

Çocuklarda Skleral Fiksasyonlu Arka Kamara Göz İçi Lens İmplantasyonu Uygulaması

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ABSTRACT Objective: To evaluate the safety and visual outcome of primary or secondary transcleral fixation of posterior chamber intraocular lenses (PC-IOLS) in pediatric eyes with inadequate capsular support as a result of various etiologies. **Material and Methods:** The records of 18 eyes of 13 patients (11 male, 2 female; mean age: $6,46 \pm 1,89$ years) underwent TF of PC-IOL implantation between June 2011 and May 2013 have been retrospectively reviewed. The indications for suturing an IOL in the sulcus of a child were insufficient capsular support, inability to use contact lenses or unable to wear aphakic spectacles. Etiologic factors, preoperative and postoperative visual outcomes, intraoperative and postoperative complications were evaluated. **Results:** Postoperative visual acuity was significantly improved after surgery ($p<0,05$). Early postoperative complications were minimal. Postoperative complications were anterior synechiae (2 eyes, 10%), suture infection (2 eyes, 10%), incisional suture breakage (1 eye, 5%) and intraocular lens dislocation (1 eye, 5%). **Conclusion:** Transscleral fixation of PC-IOL implantation in children is a relatively safe and common procedure to provide sufficient visual outcome in eyes with inadequate capsular support. Expectancy of visual outcome is mainly related to etiology.

Key Words: Lens implantation, intraocular; lens diseases

ÖZET Amaç: Çeşitli nedenlere bağlı olarak yetersiz kapsül desteği bulunan pediatrik olgularda primer veya sekonder uygulanan skleral fiksasyonlu arka kamara göz içi lens (GİL) uygulamasının görsel sonuçlarının ve etkinliğinin değerlendirilmesi. **Gereç ve Yöntemler:** Haziran 2011 ve Mayıs 2013 arasında kliniğimizde skleral fiksasyonlu göz içi lens implantasyonu uygulanan 13 hastanın 18 gözü (11 erkek, 2 kız; ortalama yaş: $6,46 \pm 1,89$ yıl) retrospektif olarak incelendi. GİL'i yerleştirebilecek yeterli kapsül desteğinin olmaması, kontakt lens veya afakik gözlük kullanamama, GİL'in sulcus sütüre edilme endikasyonlarını oluşturmaktaydı. Etiyolojik faktörler, ameliyat öncesi ve sonrası görme keskinlikleri, ameliyat sırasındaki ve sonrasındaki komplikasyonlar değerlendirildi. **Bulgular:** Ameliyat sonrası görme keskinliğindeki artış istatistiksel olarak anlamlıydı ($p<0,05$). Erken dönem postoperatif komplikasyonlar nadir olarak izlendi. Anterior sineşi (2 göz, %10), sütün enfeksiyonu (2 göz, %10), insizyonel sütün kopması (1 göz, %5) ve intraoküler lens dislokasyonu (1 göz, %5) ameliyat sonrasında izlenen komplikasyonları oluştuyordu. **Sonuç:** Çocuklarda skleral fiksasyonlu arka kamara göz içi lens uygulanması nispeten güvenli bir yöntem olup yeterli kapsül desteği bulunmayan gözlerde yeterli görsel başarıyı sağlamaktadır. Görsel prognoz etiyojiye bağlıdır.

Anahtar Kelimeler: Lens implantasyonu, göz içi; lens hastalıkları

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Optical rehabilitation of aphakia in eyes with no capsular support is problematic in pediatric patients who can not tolerate contact lenses or spectacles. There is controversy about the relative effi-

cacy and safety of the different intraocular lens (IOL) implantation approaches, as well as their indications. Options for IOL implantation in the absence of capsular support are; open-loop anterior chamber IOL implant, iris fixated IOL implant and scleral sutured (fixated) IOL implant.¹⁻⁵ Pediatric patients underwent anterior chamber lens implants have had significant long-term complications such as corneal endothelial loss, corneal decompensation, iris sphincter erosion, pupillary ectopia and glaucoma, making this procedure undesirable.^{1,5,6} Iris-claw lenses are also placed in the anterior chamber, but instead of being supported in the angle, they are attached to the iris with small polymethylmethacrylate (PMMA) clips that are part of the implant. They have been as effective as other treatment modalities in children.⁷ Unfortunately, these lenses are not routinely available in clinics. Because of the problems associated with anterior chamber IOLs and the lack of availability of iris-supported IOLs, sutured posterior chamber IOLs are preferred for secondary implantation in the pediatric population.^{2,7,8}

In children, this procedure typically is applied for 3 types of cases: (1) patients with severe enough trauma to disrupt zonular support sufficiently to make sulcus or capsular bag fixation risky; (2) patients who had a complete lensectomy, either as part of congenital cataract removal or some other ocular procedure; and (3) patients with subluxated lenses that are idiopathic or as a result of Marfan syndrome or familial ectopic lentis. Numerous reports have claimed that this approach was relatively safe, effective, and caused few complications in the pediatric age group.^{5,7,9}

The goal of this study is, to evaluate the safety and visual outcome of secondary transscleral fixation of posterior chamber IOLs (PC-IOLs) in pediatric eyes with inadequate capsular support as a result of various etiologies.

MATERIAL AND METHODS

The records of 18 eyes of 13 patients underwent transscleral fixation of posterior chamber intraocular lens implantation in Gazi University Eye Cen-

ter between June 2011 and May 2013 have been reviewed. Study design is retrospective, consecutive, series of cases. The inclusion criteria were patients previously failed contact lens and/or glasses wear and had an insufficient remnant of posterior capsular tissue for sulcus fixation. Exclusion criteria included >10 years of age, poor visualization due to corneal problems, uncontrolled glaucoma, active uveitis and insufficient follow-up period (<6 months).

A complete preoperative eye examination was performed, including visual acuity by Snellen chart. For analysis the Snellen visual acuity was converted to logMAR, using the formula $\log\text{MAR} = -\log(\text{decimal acuity})$, where decimal acuity equals the calculation of the Snellen value (ie, 20/200= 0.1, 20/20= 1.0). Intraocular pressures were measured with a Tonopen or Goldmann applanation tonometer. Prior to surgery, each child underwent examination under anesthesia to perform additional examinations and biometry of both eyes. Keratometry was performed with a hand held autorefractometer (Righton Retinomax 3, VSY) with an average of at least 2 readings that varied by <1D. Applanation A-scan biometry of both eyes was performed. Measures were taken from the scan with the best waveforms (i.e., highest peaks with a perpendicular retinal spike) using the aphakic or phakic setting depending on lenticular condition of the patients. Also gonioscopy, scleral depression, funduscopy were performed before surgery, with the patient under anesthesia. The IOL power was determined in the operating room based on A-scan ultrasonography and keratometry readings using the SRK II formula (Innovative Imaging Inc, Sacramento, CA). Lens power selections were made based on age and refractive status of the fellow eye by previously published criteria but generally undercorrecting those children who were less than 6 years of age, in anticipation of a subsequent myopic shift in their refractive status.¹⁰ Because the lens was implanted in the sulcus, one diopter was subtracted from the final calculation. For statistical analyses, Wilcoxon Signed Ranks Test was performed. A *p*-value of 0,05 or less was considered to be statistically significant.

SURGICAL PROCEDURE

The surgical approach has been described in details at previous publications.^{8,11} All of the surgeries were done by the same surgeon (A.M.H.). A superior conjunctival limbal incision was made extending for approximately 120°. Two additional small limbal conjunctival incisions were made at nasal and temporal portion. A 1-piece PMMA 6-mm optic posterior-chamber IOL with haptic eyelets (Alcon® CZ70BD) was used in all cases. A double-armed 10-0 polypropylene suture (Alcon® PC-9) with a straight needle was used. The external suturing was started with an intrascleral pass adjacent to the transscleral penetration site parallel to the limbus (1-1.5 mm posterior to limbus). This intrascleral pass was repeated in the respective opposite direction finally resulting in a zigzag pattern with six indentations (usually at the 3- and 9-o'clock positions). Each pass (3-4 mm) should start directly beneath the exiting site. With each pass the resistance force increased and, once the six zigzag passes were done, the suture was cut without knot (Z suture technique without using scleral flap shown in Figure 1).¹¹ The limbal incision was closed using interrupted 10-0 nylon sutures. The viscoelastic was removed and a miotic agent (Miochol) was instilled. The conjunctiva was closed using buried polyglactin 910 sutures (Vicryl, Ethicon).

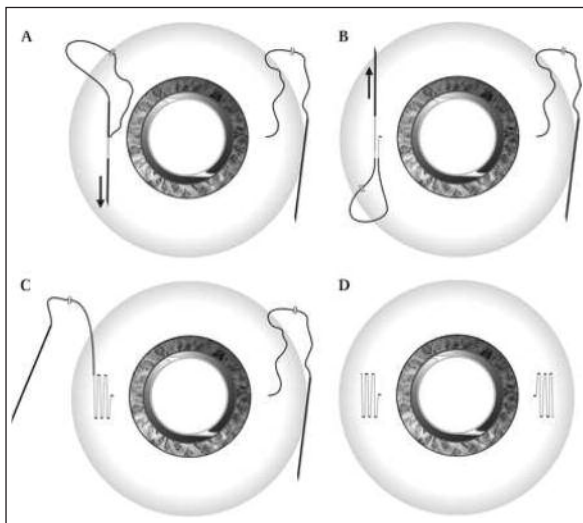


FIGURE 1: Z suture technique described by Szurman et al.¹¹

Postoperative evaluations were performed on days 1, 4, and 10, then at weeks 3 and 6, and then every 3 to 6 months thereafter, depending on the status of the eye or the need of amblyopia treatment. Visual acuity, refraction, slit-lamp examination, motility assessment, intraocular pressure measurement and funduscopy examination were performed at each visit.

RESULTS

Eighteen eyes of 13 pediatric patients were included in this study. There were 11 boys (85%) and 2 girls (15%). The mean age at surgery was 6.46 ± 1.89 years (range, 3 to 9 years). The mean follow-up for the 18 eyes in this series was 13.6 ± 5.87 months (range, 6-24 months).

Four eyes (22%) had congenital cataracts that were previously removed, leaving insufficient capsular remnants to support a sulcus supported IOL, or had received subsequent extensive membrane removal with the same result. Four eyes (22%) had trauma severe enough to either dislocate the lens, necessitating complete lensectomy, or to cause extensive zonular dehiscence, leaving no capsular support.

Ten eyes of 5 patients (55%) had subluxed lenses as the result of familial ectopic lentis. Eight eyes of four patient had subluxed lens from presumed Marfan syndrome (Figure 2). Two eyes of one patient had lens subluxation due to homocystinuria. Six patients had bilateral eye surgery, spacing 1 to 3 months.

The preoperative vision was measured with either spectacles or contact lenses. Mean preoperative spherical equivalent and best-corrected visual acuity were 3.50 ± 7.48 (-1.75 to 16.25) and 0.50 ± 0.24 logMAR units, respectively. Postoperative visual acuities were best-corrected at the patient's last follow-up examination. Mean postoperative spherical equivalent and best-corrected visual acuity were 1.37 ± 0.75 and 0.44 ± 0.23 logMAR units, respectively. The mean improvement was significant ($p < 0.05$). One eye showed no change in visual acuity and visual acuity of one child could not be evaluated due to his mental retardation. Mean preoperative and postoperative intraocular pres-

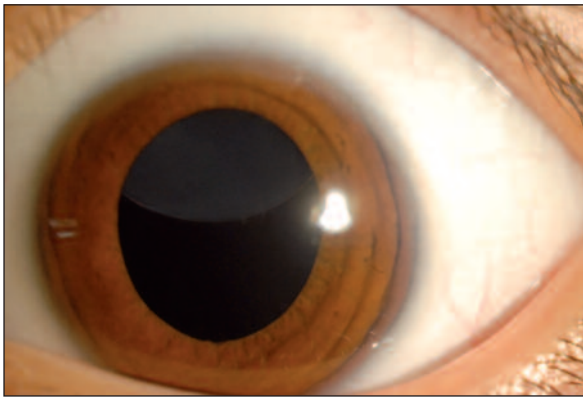


FIGURE 2: Subluxation of lens in patient with Marfan syndrome.
(See color figure at <http://www.turkiyeklinikleri.com/journal/oftalmoloji-dergisi/1300-0365/>)

sure (IOP) was 14.25 ± 1.24 mmHg and 14.56 ± 1.36 mmHg, respectively. The difference in IOP was not statistically significant ($p=0.36$) (Table 1).

No intraoperative complications were seen. Postoperative complications included anterior synechiae (2 eyes, 10%), suture infection (2 eyes, 10%), incisional suture breakage (1 eye, 5%) and intraocular lens dislocation (1 eye, 5%). No intervention needed for anterior synechiae and intraocular lens dislocation which was mild in nature and not vision threatening, suture infection was treated with topical antibiotics successfully, breakage of the corneoscleral incision suture was replaced simply with a new one.

DISCUSSION

Optical rehabilitation of aphakia in eyes with no capsular support is problematic in pediatric patients who can not tolerate contact lenses or spectacles.

TABLE 1: Preoperative and postoperative visual acuities (logMAR unit), spheric equivalent and intraocular pressures (IOP).

	Preoperative	Postoperative	p value
	Mean \pm SD	Mean \pm SD	
	Median (min; -max)	Median (min; -max)	
Visual Acuity	0.96 \pm 0.52 1.0 (0.15-2.0)	0.43 \pm 0.24 0.4 (0.09-1.0)	0.01
Refraction	3.50 \pm 7.48 2.5 (-1.75-16.25)	1.37 \pm 0.75 0.75 (-1.25-2.0)	0.04
IOP	14.25 \pm 1.24	14.56 \pm 1.36	0.36

Wilcoxon Signed Ranks Test, SD: Standard Deviation.

There are several approaches for IOL implantation in cases without capsular support: open-loop anterior chamber IOL (ACIOL) implant, iris fixated IOL implant and scleral sutured (fixated) IOL implant.¹⁻⁵ Transscleral IOL (TSSIOL) fixation is widely accepted to provide and facilitate visual rehabilitation in aphakic eyes and to avoid complications related to ACIOL implantation, like secondary glaucoma and progressive endothelial cell loss.^{6,12}

The Z suture offers a number of advantages over previous approaches to transscleral suturing.¹³ Fixing the external suture to the sclera is rapid and easy to perform with minimal opening of the conjunctiva (3-4 mm). Five zigzag passes are sufficient to resist any traction from the implant as shown in the ex vivo series. The main advantage is the knotless approach (Figure 3). By avoiding suture knots it may help to reduce complications such as scleral atrophy and suture erosion.^{11,13,14} Other techniques using corneal tissue or scleral patch graft often maintain a better protection of the knot, but are time-consuming and unreasonably invasive.¹⁵

The most important determinant of good visual outcome in childhood lenticular problems is amblyopia. If a child develops good vision before visually-significant lens subluxation, s/he probably do well after surgery. If, however, the child is at risk of amblyopia or already has amblyopia, the visual outcome is much more limited. Nonetheless, aggressive visual correction can still reverse amblyopia.¹⁶⁻¹⁸ Although all children were at risk of developing severe amblyopia, we achieved rather good visual results and, in both trauma cases, even binocular vision. The mean improvement of visual acuity was statistically significant ($p<0.05$). These were very encouraging results.

Refractive changes following IOL implantation in infants and children is difficult to predict accurately. When choosing a lens diopter for children, changes in the axial length should be considered. If the targeted refraction goal is emmetropia, amblyopia treatment will be easier but may result in myopia later in life. If the target refraction goal is hyperopia, amblyopia treatment may be more difficult, but emmetropia later in life is more likely.

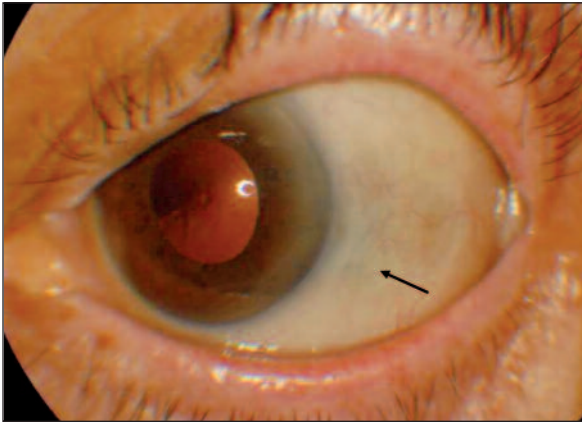


FIGURE 3: Postoperative scleral location of z suture.

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Since the children above 3 years old achieve their axial development, we chose emmetropic IOLs. According to etiology, the most challenging postoperative factor was dealing with amblyopia. Due to amblyopia, to reach target postoperative visual acuity in most of the eyes is not possible for every child.

Implantation of a TSSIOL is considerably more challenging than standard IOL implantation and entails more manipulation of the eye, especially for transscleral passage of the needles at two loci through a softened eye. Intraoperative hyphema, hypotony, and suprachoroidal hemorrhage are complications reported with higher prevalence in adult TSSIOL surgery.¹⁶ Fortunately, we did not encounter these complications intraoperatively. Late and serious complications in adults after TSSIOL implantation include suture breakage with lens dislocation, suture erosion through the conjunctiva with endophthalmitis, cystoid macular edema, and retinal detachment.^{16,17} One of the most disturbing complication of TSSIOLs is the late failure of the 10-0 polypropylene sutures through degradation or trauma, which would result in lens decentration or subluxation. Histopathologic findings have shown a lack of significant fibrosis around the lens loops, showing that the suture remains the only support for the scleral fixated IOLs.¹⁹ Polypropylene suture

is considered to be non-absorbable; however, they degrade slowly over time and are not permanent.²⁰ One report of largely adult patients found late polypropylene suture breakage in 16 of 61 eyes (26.2%) occurring about 50 months after IOL fixation.²¹ In contrast, in another report with more than 10 years of follow-up of 16 adult patients with SFIOLs, no cases of suture breakage occurred.²² While perhaps not a certainty, the concern is that 10-0 polypropylene sutures degrade and eventual breakage will increase over time and result in IOL dislocation. This is of obvious concern for the pediatric patient. In one report, the author noted that the suture breakage occurred at 3.5, 5, 6, and 8 years.²³ In another report, the average time to suture breakage and IOL dislocation was 8.7 ± 1.2 years; in this report, all IOLs were explanted.²⁴ As a result, several recommendations including the usage of multiple sutures, thicker sutures (9-0 polypropylene), and different suture materials have been put forth to reduce the risk of suture breakage and IOL dislocation.²³⁻²⁵ We experienced no breakage of polypropylene suture in this study, we only had breakage of a corneoscleral incisional suture and simply replaced with a new one. On the other hand, further research is needed to find an ideal method and/or material for fixation of IOLs to the sclera. Our postoperative complications included anterior synechiae (2 eyes, 10%), suture infection (2 eyes, 10%), incisional suture breakage (1 eye, 5%) and intraocular lens dislocation (1 eye, 5%). Based on clinical outcome information currently available, including this study, the risks of TSSIOL implantation in children appear to be acceptable. This study is limited by the small sample size and limited follow-up period. We feel that even though better methods and materials need to be developed to achieve longer-term safety for IOL implantation in the absence of capsular support, the surgical option should not be withheld from the pediatric patient facing permanent visual handicap from especially unilateral amblyopia. Long-term safety, greater than the average 13.6 months follow-up reported here, remains to be determined.

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