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ARAŞTIRMA / RESEARCH

Intrascleral sutureless fixation of three-piece intraocular lens for aphakia management

Afaki tedavisinde üç parçalı göziçi lensin sütürsüz intraskleral fiksasyonu

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Abstract

Purpose: The aim of this study was to report the technique of sutureless intrascleral fixation (SIF) of three-piece foldable intraocular lens (IOL) in patients with insufficient posterior capsule support.

Material and Methods: This study is a retrospective case series. We performed our modified technique on 54 patients. A 27-gauge needle was used to remove the haptics of the IOL from the scleral tunnel. The tips of the haptic were cautherized and then inserted into the scleral tunnel. The preoperative and postoperative best-corrected visual acuity (BCVA), intraocular pressure (IOP), and complications were evaluated.

Results: Fifty-four patients (24 women, 30 men) were included. The mean age was 52.4±14.5 years. The mean follow-up was 12±6.8 months. The mean preoperative BCVA (Snellen) was 20/500. At the postoperative first month, the mean BCVA was 20/80. The mean preoperative IOP was 12.5±3.5 mm Hg, at first month it was 12.8±6.5 mm Hg. Postoperative complications included subconjunctival hemorrhage in 12 patients, hyphema in 2 patients, and vitreous hemorrhage in 1 patient. There was no occurrence of haptic exposure, IOL tilted or decentration during the follow-up in this study.

Conclusion: SIF of three-piece IOL is a reliable, rapid and easy to apply method. There are no significant changes in IOP and no permanent complications after surgery. It is also a succesful method in view of the consequential apparent improvement in visual acuity.

Key words: Aphakia, sutureless fixation, intrascleral fixation, three-piece intraocular lens

Öz

Amaç: Bu çalışmanın amacı kliniğimizde yetersiz arka kapsül desteği olan hastalarda uyguladığımız üç parçalı göz içi lensin (GİL) intraskleral fiksasyon yöntemini sunmaktır.

Gereç ve Yöntem: Bu çalışma retrospektif vaka serisinden oluşmaktadır. Oluşturulan skleral tünelden GİL haptiğini çıkarmak için 27 gauge iğne kullanıldı. Haptik uçları topuz şeklinde koterize edildi ve haptikler skleral tünel içine yerleştirildi. Ameliyat öncesi ve sonrası düzeltilmiş görme keskinliği, göz içi basıncı ve komplikasyonlar değerlendirildi.

Bulgular: 54 hasta (24 kadın, 30 erkek) çalışmaya dahil edildi. Ortalama yaş 52.4±14.5 yıldı. Ortalama takip süresi 12±6.8 aydı. Ameliyat öncesi görme keskinliği 20/500 idi. Ameliyat sonrası 1. ayda 20/80 idi. Göz içi basınç ameliyat öncesi 12.5±3.5 mm Hg iken 1. ayda 12.8±6.5 mm Hg idi. Ameliyat sonrası komplikasyon olarak 12 hastada subkonjonktival kanama, 2 hastada hifema, 1 hastada vitreus hemorajisi gelişti. Hiçbir hastada haptik exposure, GİL desentralizasyonu takip süresinde gelişmedi.

Sonuç: Üç parçalı lensin sütürsüz intraskleral fiksasyon metodu güvenilir, hızlı ve uygulaması kolay bir methodtur. Cerrahi sonrası göziçi basıncında önemli değişiklikler olmamakta, kalıcı komplikasyon gelişmemektedir. Ayrıca görme keskinliğinde artış sağladığı için başarılı bir yöntemdir.

Anahtar kelimeler: Afaki, sütürsüz fiksasyon, intraskleral fiksasyon, üç parçalı göz içi lens

INTRODUCTION

Secondary artificial intraocular lens (IOL) implantation is a standard procedure both in posttraumatic and postoperative aphakia. IOL implantation in eyes with lack of posterior capsular support has been accomplished in the past by using iris-fixated IOL, anterior chamber (AC) IOL, and transscleral IOL fixation through the ciliary sulcus

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or pars plana [1-3].Sclerally fixated IOL implantation can be a treatment option in the visual rehabilitation of eyes with insufficient posterior capsule support because it results in few postoperative complications and high visual acuity improvement rates.

Sutureless intrascleral fixation (SIF) of IOLs has become more popular[4-7]. This technique is compatible with repair of iris trauma and allows sutureless fixation of the haptics in scleral tunnels parallel to the limbus, while minimizing the risk of postoperative astigmatism. Furthermore, iris fixation is impossible in cases of significant iris trauma; scleral sutures are often technically difficult and expose the patient to late IOL dislocation or tilt[8].

Herein, we describe our modified technique for SIF of a three-piece IOL using 27-gauge needles. This technique requires no special instruments and provides good IOL fixation with good wound closure without leakage.

MATERİAL AND METHODS

We performed a retrospective study of patients who underwent SIF surgery between February 2016-December 2016 at Adana Numune Training and Research Hospital, Adana, Turkey. The study was approved by the Ethics Committee of Adana Numune Training and Research Hospital (13-2017) and performed in accordance with ethical standards of the Helsinki Declaration. Informed consent was obtained from the patients.

This study included 54 eyes of 54 patients (24 women, 30 men). The mean age was 52.4±14.5 years (range, 18-75 years). The mean follow-up was 12±6.8 months. The preoperative diagnoses were as follows: nucleus drop during cataract surgery (n=6 eyes), intraocular lens subluxation into the vitreus cavity (n=12), lens luxation into the vitreus cavity (n=10), intraocular lens drop (n=3), post complicated cataract surgery (n=23).

All patients were seen on the day after surgery, 1 week after, and 1 month, 2 months, and 6 months after surgery, and at clinically indicated intervals thereafter. The preoperative and postoperative best-corrected visual acuity (BCVA) was evaluated using Snellen visual acuity charts, intraocular pressure (IOP) using a non-contact tonometer, and anatomic outcomes and complications were recorded.

All surgeries were performed by the same surgeon (EÇ).

Surgical technique

All patients were counseled preoperatively about the risk of the surgery. The operative eye was prepared and draped in the usual sterile ophthalmic fashion. All eyes were operated under local anesthesia (sub-tenon Jetokain). The peripheral cornea was marked using a tissue pen at two points 180° from each other. After peritomies were performed, two 3-mm scleral tunnels were created 1.5 mm from the limbus and parallel to the limbus using a 20-gauge microvitreoretinal (MVR) knife or a 27-gauge needle at the 3 and 9 o'clock positions.

Technique for eyes that did not require pars plana vitrectomy (PPV)

A 27-gauge needle (like an insulin needle) was used at a 60° angle to grasp, secure, and subsequently externalize one haptic at a time through the appropriate sclerotomy. A 2.8-mm corneal incision was made at 12 o'clock. An anterior vitrectomy was performed and viscoelastic gel was injected into the anterior chamber.

A 27-gauge needle was inserted at the end of one intrascleral tunnel and directed into the mid-vitreus cavity. While the three-piece foldable IOL was injected into the eye through the corneal incision, the haptic of the IOL was inserted into the hollow needle. All secondary IOLs used were Alcon (Alcon Laboratories Inc., Fort Worth, TX) MA60AC three-piece IOLs. The haptic was removed by withdrawing the needle and cauterizing the tips of the haptic and then inserting it into the scleral tunnel.

The same procedure was performed for the other haptic. After injecting viscoelastic gel into the anterior chamber, with the 27-gauge needle held in the right hand, the haptic tip was grasped with forceps, pushed through the hollow needle, and externalized via the needle on the right side. The haptics were then properly placed into the scleral tunnel by pushing their tips. Excess viscoelastic gel was cleaned from the eye and the corneal incision was closed using stromal hydration or a 10/0 nylon suture. The conjunctiva was then closed using 8/0 Vicryl (Figure 1).

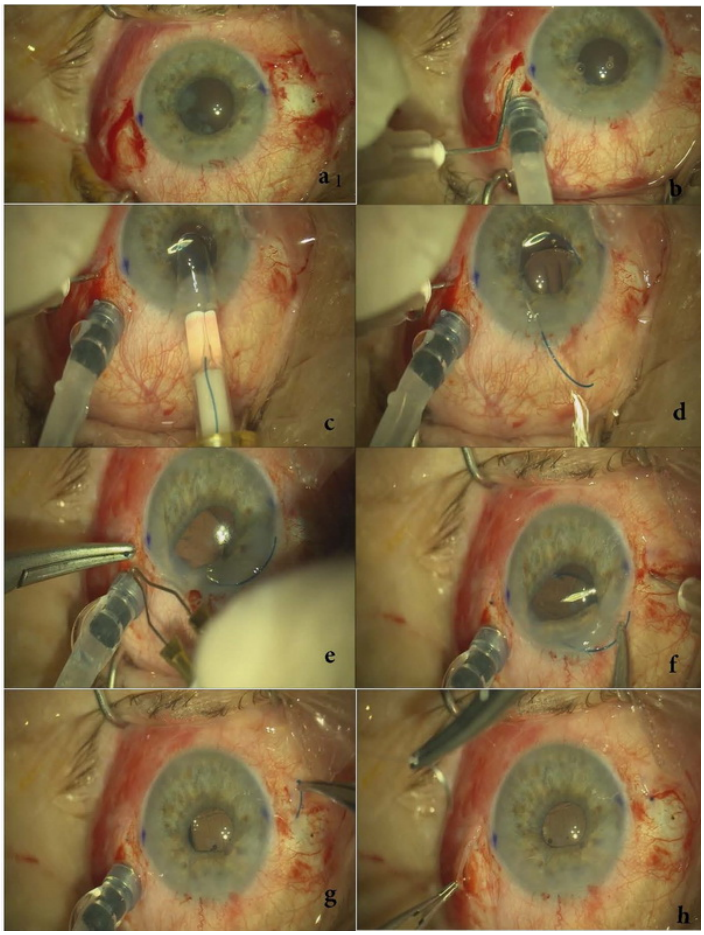

Figure 1: Surgical steps for sutureless intrascleral fixation of secondary intraocular lens.
a) Marking of the peripheral cornea 180° from each other, and conjunctival peritomies were performed b) Creating the 3-mm scleral tunnels 1.5 mm from and parallel to the limbus, c) Implantation of IOL with the injector, inserting the haptic of the three-piece IOL into the hollow needle in the pupillary area, d) Removing the haptic by withdrawing the needle from the scleral tunnel, e) Cauterizing the tip of the haptic f) Inserting the second haptic into the hollow needle, g) Removing the haptic and cauterizing the tip, h) Inserting the tips of the haptic into the scleral tunnels; at the end of surgery the IOL seems perfectly centralized.

Technique for eyes that required PPV

After creating scleral tunnels, a 23-guage three-port PPV was performed for patients with nucleus drop/subluxation or IOL drop/subluxation. The same procedure was performed as described above. Sutures were required for sclerotomies. The conjunctiva was then closed using 8/0 Vicryl.In lens subluxation cases, the lens was removed using the intracapsular cataract extraction method and then anterior vitrectomy and intrascleral IOL fixation was performed.In patients with requiring PPV; scleral fixation was performed without removing the infusion port to prevent hypotonia. And in eyes with hypotoni, we used infusion fluid to form ocular tonisite. Postoperative medication included topical drops (antibiotics and steroids) initially given 5 times daily and then tapered slowly over 4 weeks.

Statistical analysis

Statistical analysis of the data was performed using SPSS version 15.0 (SPSS Inc., Chicago, IL, USA).

The Wilcoxon signed-rank test was used to determine the significance of any association between the preoperative and postoperative BCVA and IOP. A p value <0.05 was considered statistically significant.

RESULTS

Twenty-four women and 30 men were included this study. The mean age was 52.4±14.5 years (range, 18-75 years). The mean follow-up period was 12±6.8 months. Six eyes had nucleus drop (4 due to trauma, 2 due to complicated cataract surgery), 12 eyes had IOL subluxation into the vitreus cavity, 10 eyes had cristalline lens subluxation into the vitreus cavity, 3 eyes had IOL drop, and 23 eyes had undergone complicated cataract surgery. Table 1 shows the indications for surgery.

Table 1. Indications for Surgery

Indications for Surgery	Patients,n (%)
Subluxated crystalline lens	10 (18%)
Luxated crystalline lens	6 (11%)
Subluxated IOL	12 (22%)
Luxated IOL	3 (0.05 %)
Aphakia after complicated cataract surgery	23 (42%)

IOL: Intraocular lens

The mean preoperative BCVA was 20/500 (ranging from perception of light to 2/20 Snellen visual acuity). At the first postoperative month, BCVA was 20/80 (ranging from 20/250 to 20/32 Snellen visual acuity). Six months later, BCVA was 20/40 (ranging from 20/80 to 20/25 Snellen visual acuity) (p<0.05). None of the patients had decreased visual acuity (Table 2).

Table 2. Outcomes of the best corrected visual acuity and intraocular pressure.

	BCVA (Snellen)	IOP (mmHg Appl)
Preoperative	20/500 (p+-2/20)	12.5±3.5
Postoperative		
1th week	20/250 (20/1250-20/66.6)	13.8±7.5
1th month	20/80 (20/250-20/32)	12.8±6.5
6th month	20/40 (20/80- 20/25)	12.3±4.8

BCVA: Best corrected visual acuity, IOP: intraocular pressure

Mean postoperative spherical equivalent (SE) was 0,37 +/- 1,20 D. The mean preoperative IOP was 12.5±3.5 mm Hg; at the first month it was 12.8±6.5 mm Hg, and six months after the operation it was 12.3±4.8 mm Hg (p=0.12). None of the patients required antiglaucomatous therapy. None of the patients had serious complications such as postoperative endophthalmitis, glaucoma or retinal detachment. Postoperative complications included subconjunctival hemorrhage in 12 patients, hyphema in 2 patients, and vitreous hemorrhage in 1 patient. Hyphemas resolved in one week, and the vitreous hemorrhage resolved in two weeks with observation alone. We observed no conjunctival or scleral erosion or inflammation. There was no occurrence of haptic exposure, IOL tilt or decentration during follow-up in this study.

DISCUSSION

Numerous techniques have been developed for IOL implantation in eyes without sufficient capsular support. Transscleral fixation of PC-IOL implantation is a safe procedure for providing sufficent visual results in eyes with inadequate capsular support. Nottage and colleagues in a study of 69 patients after transscleral fixation observed glaucoma (5.8%), cystic macular edema (5.8%), bullous keratopathy (4.3%), retinal detachment (1.4%), uveitis (1.4%), keratitis (1.4%), and choroidal hemorrhage (1.4%) after 14 months of follow-up [9]. The authors observed 1 suture erosion 2 years after surgery.

In the literature, the incidence of suture erosion was reported as 17% in the presence of scleral flap, and 5-50% in only conjunctival flap formation.[10-12] Endophthalmitis is one of the most serious and vision-threatening complications of IOL implantation with scleral fixation. The development of this complication has been associated with suture removal.[13,14] Some publications suggest that prolene sutures erode the surface and increase endophthalmitis risk when a scleral flap is not used,

whereas other publications claim that scleral flaps cannot adequately prevent endophthalmitis.[13-15]

In order to minimize these risks in patients with deficient capsular support and enhance surgical efficiency, various scleral fixation techniques have been developed to position IOLs within the ciliary sulcus. Anand et al.[16] first described the technique of knot embedding. Friedberg and Berler [17] reported a knot embedding technique into the scleral cleft, and Bucci et al.[18] preferred to hide the knot in the corneal tissue.

Sutureless intrascleral IOL fixation methods are newer and very popular. They have been developed to eliminate suture-related complications of sutured scleral fixation methods such as suture-induced inflammation or infection, and IOL dislocation or subluxation due to suture degradation. Various methods of SIF have been described. Some surgens prefer to create scleral tunnels, whereas others use scleral flaps for scleral fixation of haptics. In the SIF technique described by Gabor and Pavlidis [6], IOL haptics are incarcerated into the prepared scleral tunnel without sutures, thereby allowing stability confidently. This technique was performed in 66 patients incurring less trauma and requiring less scleral manipulation. The authors emphasized that scleral tunnel incarceration of haptics provided IOL stabilization and decreased the incidence of IOL tilt. Scharioth et al. described a technique for embedding the haptics of a three-piece IOL within scleral tunnels, resulting in an SIF [7]. This technique was further modified by Prenner et al. using instruments for the posterior segment surgeon. [19] Subsequently, Prasad described a technique using transconjunctival trocars to avoid sutures.[20]

Abbey et al. evaluated their experience with two SIF techniques (tunnel and cannula techniques) that utilize the instruments and skills of a posterior segment surgeon. Both techniques demonstrated statistically significant improvement in visual acuity and a low incidence of both short- and long-term complications [21].

Kawaji et al.[22] reported that inserting the IOL haptic into the scleral tunnel, as described by Gabor and Pavlidis [6], was not easy because the sclerotomy and scleral tunnel were too close to each other; to resolve this difficulty the authors added a lameller scleral dissection at the outer wall of the scleral tunnels, so the haptic was grasped and introduced into the scleral tunnel using forceps.

A relatively new technique is fibrin-glue assisted sutureless fixation described by Agarwal [4]. In this technique, scleral flaps are made horizontally at 3 and 9 o'clock (as also described for standard trans-scleral suture fixation procedures), the intrascleral haptic of a posterior chamber IOL is glued to the sclera. One-year results showed good outcomes [23]. In 2012, Ohta introduced the Y-fixation technique in which the IOL is fixed without large lameller scleral flaps and fibrin glue [24].

In the present study, we have shown the functional results of the SIF with three-piece IOL technique. In this technique, we used a 27-gauge needle to create both the scleral tunnel and to extract the haptic. Before putting the haptic into the tunnel, we cauterized the tips of the haptic like a knob, thus the haptics were secured in the tunnel. We did not create another tunnel. As such, this technique decreases intraoperative maneuvers and the risk of trauma. Standard scleral fixation with sutures requires wide corneal or scleral incisions, which results in significant postoperative astigmatism. In this SIF technique, the foldable hydrophobic acrylic three-piece IOLs are inserted through a conventional sub-2.8 mm clear corneal incision. The placement of second haptic more difficult than placement of the first haptic. At initial, the corneal incision can be made wider towards to second haptic to prevent haptic deformation. It is easier to place second haptic holding it closer to the haptic tip with a curved forceps.

The SIF-IOLs technique appears to be equally good in eyes with aphakia after complicated cataract surgery, luxated IOL or cristalline lens. The SIF of the three-piece IOL technique allowed an exact centration of the IOL and provided axial stability. Another advantage of this technique is the speed and ease of surgery. We determined good visual outcomes with minimal complications in this method. In our study, postoperative complications occurred in 15 eyes; hypema in two patients and vitreous hemorrage in one patient, which resolved without medication. Another advantage of this technique is that it can be combined with PPV in patients with subluxated/luxated IOL or crystalline lenses. If a luxated IOL were a three-piece IOL, we could use this IOL for intrascleral fixation without extraction. Therefore, we can think this method is also cost saving in some patients. The greatest advantage of this technique is that this is a sutureless

method, as such there are no complications due to using sutures.

There are limitations to our study, including its small sample size, short follow-up period, and lack of control group. Also ,unfortunately we haven't ultrasonographic biomicrocopy or anterior optic coherence tomography. So, IOL centralization was assessed by observing intraocular lens position (tilted, luxation..) with eye movements on biomicroscopic examination. If IOL haptic is not observed in the pupil range was considered it is centralized.

We believe this technique has advantages over previously described methods because the sclerotomy is small and the IOL haptic is easily fixed in the scleral tunnel. Further studies with more patients and longer follow-up periods are needed to determine the long-term anatomic and functional results. Sutureless intrascleral fixation of a three-piece IOL technique is a reliable method because it is quick and easy to apply, there are no significant changes in intraocular pressure, and no permanent complications after surgery. It can be considered a succesful method in view of the apparent improvements in visual acuity.

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