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ORIGINAL ARTICLE

Sutureless transconjunctival intrascleral intraocular lens fixation: the modified Yamane technique

Fixação de lente intraocular intraescleral transconjuntival sem sutura: técnica de Yamane modificada

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ABSTRACT | Purpose: To evaluate the efficacy and safety of the modified Yamane technique with sutureless transconjunctival intrascleral intraocular lens fixation. **Methods:** Sutureless transconjunctival intrascleral haptic fixated intraocular lens implantation was performed in patients with aphakia and dislocated intraocular lenses. A clear corneal incision (2.8 mm) was made into the temporal quadrant and a three-piece intraocular lens was implanted into the anterior chamber. The haptics of the intraocular lens were externalized with a 27 G needle via transconjunctival scleral tunnels at the 6 and 12 o'clock positions. The transconjunctival scleral tunnels were prepared to conform to the haptic position and curvature. The site of the scleral tunnels was 2mm from the limbus with a length of 2 mm in the sclera and was aimed at the end of the posterior chamber. The tips of the haptics were cauterized to create a terminal knob. The haptics were pushed back and the knobs were implanted into the scleral tunnels. **Results:** The study cohort included 21 patients with unilateral aphakia and dislocated intraocular lenses. All patients were examined postoperatively and at postoperative day 1, day 7, month 1, and month 3. All examinations revealed formation of the anterior chamber and well-centralized intraocular lenses. No haptic-related complications of exposure, foreign body sensation, or discomfort were observed. **Conclusion:** Sutureless transconjunctival intrascleral haptic fixated intraocular lensimplantation is an effective, safe, and practical surgical alternative. This technique was superior to the Yamane method with regard to comfort and surgical duration. Further studies with longer follow-up evaluations are warranted to verify long-term complications.

Keywords: Aphakia; Intraocular lens implantation; Lens, intraocular; Sutureless surgical procedures/instrumentation; Ophthalmologic surgical procedures/methods

RESUMO | Objetivo: Avaliar a eficácia e a segurança da técnica de Yamane modificada com a fixação de lenta intraocular transconjuntival sem sutura. **Métodos:** O implante de lente intraocular intraescleral e transconjuntival sem sutura foi realizado em pacientes com afacia e lentes intraoculares luxadas. Uma incisão em córnea clara (2,8 mm) foi feita no quadrante temporal e uma lente intraocular de três peças foi implantada na câmara anterior. Os hápticos da lente intraocular foram externalizados com uma agulha 27G através de túneis esclerais transconjuntivais nas posições de 6 e 12 horas. Os túneis esclerais transconjuntivais foram preparados para se ajustarem à posição e curvatura hápticas. O local dos túneis esclerais foi de 2 mm do limbo com um comprimento de 2 mm na esclera e foi destinado ao final da câmara posterior. As pontas dos hápticos foram cauterizadas para criar uma saliência terminal. Os hápticos foram empurrados para tras e as saliências foram implantadas nos túneis esclerais. **Resultados:** A coorte do estudo incluiu 21 pacientes com afacia unilateral e lentes intraocular deslocada. Todos os pacientes foram examinados no pós-operatório e no dia 1, 7, 1 mês e 3 meses do pós-operatório. Todos os exames revelaram formação da uma câmara anterior e lentes intraoculares bem centralizadas. Nenhuma complicação hápticas relacionada à exposição, sensação de corpo estranho ou desconforto foram observadas. **Conclusão:** O implante de lente intraocular transconjuntival intraescleral sem sutura é uma alternativa cirúrgica eficaz, segura e prática. Esta técnica foi superior ao método de Yamane no que diz respeito ao conforto e duração cirúrgica. Mais estudos com avaliações de seguimento mais prolongados são necessários para verificar as complicações de longo prazo.

Descritores: Afacia; Implante de lente intraocular; Lentes intraoculares; Procedimentos cirúrgicos sem sutura/instrumentação; Procedimentos cirúrgicos oftalmológicos/métodos

INTRODUCTION

Aphakia is an undesirable complication of cataract surgery. There are several treatment approaches to

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improve visual disturbances secondary to aphakia. Secondary intraocular lens (IOL) implantation methods in aphakic eyes without capsular support include IOL implantation into the anterior chamber (AC), iris-fixated IOL implantation, and scleral-fixated posterior chamber IOL implantation (SF-PC-IOL)[1-3]. In aphakia rehabilitation, SF-PC-IOL implantation is preferred over other approaches. Since it reduces the iris contact with IOL, and prevents the cornea and iridocorneal angle damage due to distance, the risks of pupillary block, secondary glaucoma, and iritis are relatively lowwith SF-PC-IOL implantation, as compared to iris-fixated or IOL implantation into the AC[4-8]. Despite these advantages, suture-related complications, such as suture rupture or erosion, may occur[9].

In 2008, Agarwal et al.[10] in their study described a sutureless intrascleral posterior chamber IOL fixation technique with the use of fibrin glue rather than sutures. The major disadvantages of this technique are wide sclerotomies and the risk of ocular hypotony due to sclerotomy closure using fibrin glue without suture augmentation. Yamane et al.[11] in their study reported that the intrascleral haptic-fixated IOL implantation technique with the use of fibrin glue rather than sutures significantly reduced the risk of complications.

Hence, the aim of the present study was to investigate the efficacy and safety of the modified Yamane technique with sutureless transconjunctival intrascleral intraocular lens fixation using a less invasive method.

METHODS

The records of patients who underwent the modified Yamane technique with sutureless transconjunctival intrascleral intraocular lens fixation at the Van Education Research Hospital of Health Sciences University (Van, Turkey) between February 2017 and October 2017 were retrospectively reviewed. Patients with aphakia and dislocated IOL were included in the study, while those who underwent vitreoretinal surgery and had a follow-up duration of less than three months were excluded from analysis.

The best corrected visual acuity (BCVA) of the patients was measured with Snellen charts prior to surgery. Goldmann applanation tonometry was used to measure intraocular pressure (IOP). A detailed anterior segment and fundus examination was performed. Prior to surgery, keratometric measurements of the patients were taken and the Sanders-Retzlaff-Kraff/Theoretical formula was used to calculate the power of the posterior chamber IOL aiming for emmetropia. The Eyecryl Plus three-piece, foldable, acrylic IOL (TP6130; Biotech Vision Care Pvt., Ltd., Ahmedabad, Gujarat, India) was used for implantation.

Before surgery, 0.5% proparacaine (0.5% Alcaine; Alcon, İstanbul, Turkey) was instilled to provide topical anesthesia. Lidocaine (4 cc, 20 mg/mL; Jetokain, Adeka, Turkey) was injected retrobulbarly with insufficient orientation to topical anesthesia. A 2.8-mm clear corneal incision was made into the temporal quadrant. A coaxial anterior vitrectomy was performed in cases with vitreous in the AC. Then, 1.4% sodium hyaluronate (Protectalon;VSY Biotechnology, İstanbul, Turkey) was injected into the AC. A three-piece IOL was implanted into the AC with the use of an injector system, while the trailing haptic was kept outside the AC.

Firstly, a transconjunctival scleral tunnel was prepared with a 27-gauge insulin needle at the 12 o'clock position. The first haptic was pushed into the lumen of the insulin needle with utrata forcepsand the first haptic was externalized with an insulin needle. Theforceps were entered into the AC through the main incision. Aterminal knob was formed by cauterizing the haptic with a battery-operated thermal cautery unit. The created knob was pushed and fixed into the scleral tunnel. The same procedure was followed for the second haptic at the 6 o'clock position.

Transconjunctival scleral tunnels were prepared to conform to the haptic position and curvature. The site of the scleral tunnels was 2mm from the limbus, with a length of 2 mm in the sclera, aimed at the end of the posterior chamber. After implantation of the IOL, the corneal incision was hydrated with balanced salt solution following intracameral viscoelastic removal (Figure 1).

Postoperatively, 1% prednisolone acetate eye drops (1% Pred Forte; Allergan, Istanbul, Turkey) were applied every hour for the first two days, which was then tapered and stopped at postoperative week four. Topical 0.5% moxifloxacin (0.5% Vigamox, Alcon, Turkey) was applied every 4h for 10 days. Follow-up examinations included BCVA, IOP measurement, and evaluation of the anterior and posterior segments on postoperative day 1, week 1, month 1, and month 3.

IBM SPSS Statistics for Windows, version 23.0, software (IBM Corporation, Armonk, NY, USA) was used for statistical analysis. Parameters, including the BCVA and IOP both before and after surgery, were compared using the paired samples *t*-test. A probability (*p*) value of <0.05 was considered statistically significant.

RESULTS

Of the 21 patients included in this study, 12 were male (57.14%) and nine were female (42.86%) with a mean age of 70.20 ± 9.50 (range, 59-97) years. The mean axial length of the eyes of the patients was 22.02 ± 1.05 (range, 20.12-24.03) mm. Anterior vitrectomy with IOL implantation was performed for seven patients and two patients with dislocated IOL (foldable one piece IOL) underwent anterior vitrectomy with IOL exchange.

The BCVA before and at postoperative month 3 was 0.21 ± 0.88and 0.09 ± 0.85logMAR, respectively. Visual recovery was statistically significant and none of the eyes had deterioration in visual acuity (p=0.001). There was no significant difference in mean IOP measurements before surgery and at postoperative month 3 (14.13 ± 2.61 [range, 10-18] mmHg vs. 13.53 ± 2.90 [range, 9-19] mmHg, respectively; p=0.12). Comparisons of the BCVA and IOP before and three months after surgery are presented in table 1.

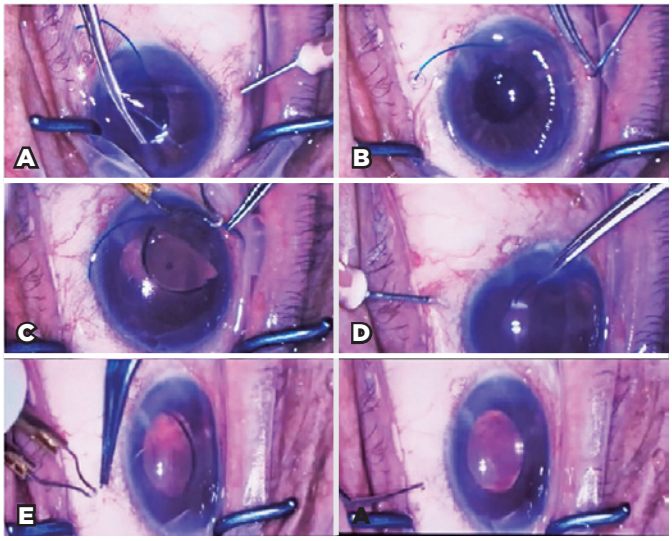

Figure 1. (A) Pushingthe IOL haptic from the 12 o'clock position into the lumen of ainsulin needle. (B) Externalization of the haptic by pulling the insulin needle. (C) Aterminal knob was formed via cauterizing the haptic edge. (D) Pushing the second haptic from the 6 o'clock position to the lumen of the insulin needle. (E) A terminal knob was formed via cauterizing the second haptic edge. (F) Pushing the formed terminal knob into the scleral tunnel

Table 1. Comparison of preoperative and 3-month postoperative BCVA and IOP parameters.

	Preoperative	Postoperative	*p*
BCVA (logMAR)	0.21 ± 0.88	0.09 ± 0.85	0.001
IOP (mmHg)	14.13 ± 2.61	13.53 ± 2.90	0.12

BCVA= best corrected visual acuity; IOP= Intraocularpressure.

During surgery and the early postoperative period, there were no complications of IOP elevation, hyphema, vitreous hemorrhage, IOL tilt or decentralization, or iris capture. All follow-up examinations revealed formation of the AC and good centralization of the IOL. Cystoid macular edema was observed in one patient at postoperative week six. Also, there were no haptic-related complications, such as exposure, scleral atrophy, discomfort, foreign body sensation, or conjunctival scar formation (Figure 2).

DISCUSSION

Various methods have been used in for IOL implantation into the posterior chamber with scleral fixation. Suture exposure and associated late endophthalmitis are the most important late-stage complications of trans scleral IOL suture fixation. To prevent these complications, the knobs are buried under the scleral flap[12]. The most commonly preferred surgical method is to form a scleral flap after conjunctival dissection and to close it by suturing the knob under the flap, thereby preventing complications related to scleral suture exposure. However, Solomone et al.[13] in their study reported that long-term suture erosion occurs in73% of patients even if a scleral flap is made and they concluded that this method does not prevent, but rather delays, the onset of suture erosion. Although the long-term outcomes of intrascleral IOL fixation without sutures remains unknown, this procedure has gained popularity due to some advantages over other methods[10-11]. In the present study, the results of anew intrascleral IOL fixation method without the use of fibrin glue or suture are discussed.

The method used in the present study is a modified version of a procedure described in the study by Yamane et al.[11] as "flanged intrascleral intraocular lens fixation with double-needle technique," which included a series of 100 patients. Our method has some advantages over the method described in the study by Yamane et al. in terms of applicability and practicality (Table 2). In this

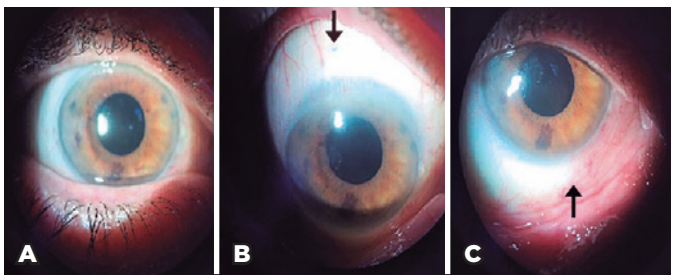

Figure 2. (A) Well-centered intraocular lens. (B-C) The appearance of superior and inferior edges of the lens haptics (arrows).

Table 2. Advantages of our modified technique over the method described in the study by Yamane et al. in terms of applicability and practicality

Yamane et al.	Our study	Advantages of our modified technique
30-gauge thin-walled needle	27-gauge needle	Freely avaible and appropriate for every 3-piece IOL
Nasal and temporal quadrants for sclerotomy	6 and 12 o'clock positionsfor sclerotomy	Haptic-related complications of exposure, conjunctival scar formation, discomfort are minimized
Double needle	Single needle	The possibility of the first haptic emerging from the needle lumen due to the IOL position and manipulation during the entry of the second haptic into the needle lumen is eliminated
More corneal ports are needed	Single corneal port is used	Less invasive method
Angled sclerotomy	Sclerotomy with 2 mm scleral tunnel	Postoperative complications such as IOL tilt, decentralization and iris capture were not observed in the early period

study, Yamane et al. used a 30-gauge thin-walled needle, which is not freely avaible in all countries. Nonetheless, the lumen of this needle is not always appropriate for three-piece IOLs. The 27-gauge needle used in our study is freely avaible and the lumen width is appropriate for routine three-piece IOL. While the study by Yamane et al. preferred angled sclerotomy, we preferred sclerotomy with a 2-mm scleral tunnel to minimize the risk of hypotony. We preferred the 6 and 12 o'clock positions for sclerotomy while Yamane et al. preferred the nasal and temporal quadrants. In this way, the haptics are under the eyelids and the risks of haptic-related complications, such as exposure, conjunctival scar formation, and discomfort, are minimized. With the technique of Yamane et al., there is a possibility of the first haptic emerging from the needle lumen due to the IOL position and manipulation during entry of the second haptic into the needle lumen. In contrast, with our method, the second haptic is fixed after intrascleral fixation of the first haptic, thus there is no need for a second needle and no risk of the first haptic leaving the needle lumen. With the method of Yamane et al., corneal side incisions are made to push the haptics into the lumen of the needle and more corneal ports are needed with the main corneal incision (3 mm). Our method is a less invasive approach, since a 2.8-mm corneal incision is made and all intraocular manipulations are performed using this port. Moreover, Yamane et al. in their study reported the need for peripheral iridotomy for IOP control for all patients, although early postoperative complications of IOL tilt and decentralization, and iris capture had occurred. Our method overcomes these complications, since the scleral tunnels fit the position and curvature of the haptics. Besides, with our technique, the needle is first inserted into the sclera and then moved parallel to the limbus by about 2 mm and aimed into the posterior chamber. Thus, these complications were not observed in the early period and peripheral iridotomy was not required.

Similar studies[10,11,14,15] have reported various complications, such as IOP elevation, hyphema, vitreous hemorrhage, IOL decentralization, and cystoid macular edema. However, in our study, only one case of cystoid macular edema was observed during the follow-up period. Limitations to this study included a relatively low number of patients and a short follow-up period, which may have assisted in reducing the complication rate.

The modified Yamane technique with sutureless transconjunctival intrascleral intraocular lens fixation is an effective, safe, and practical method with some advantages over the method described by Yamane et al. in terms of applicability and practicality. It is also a less invasive method that does not require the creation of conjunctival and scleral flaps or pockets, although fibrin glue or sutures are needed.

The duration of the surgery is relatively short and is quite comfortable to the patient and physician. In addition, postoperative recovery is rather short. However, patients should be followed-up for a longer period due to possible late-term complications.

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