

# Pars plana vitrectomy with transscleral fixation of posterior chamber lens in the treatment of post-traumatic lens dislocation

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## Abstract

**Purpose** To present our experience with post-traumatic lens dislocation management by vitrectomy followed with sutureless artificial lens fixation.

**Methods** The retrospective study involved 15 patients (12 men and 3 women) aged from 36 to 78 (on average, 63 years old), from the Vitreoretinal Surgery Teaching Hospital, operated in the years 2013–2015. All cases concerned ocular traumas with dislocation of the natural or artificial lens to the anterior chamber, vitreous body chamber, or post-traumatic aphakia. After vitrectomy, patients had the implant fixated with a technique devised by Scharioth—sutureless fixation of posterior chamber implants in the groove area, with haptics placed in scleral tunnels parallel to the corneal limbus. Preoperative and postoperative condition of the eye was assessed.

**Results** The average period of observation was 29 weeks. Average pre-surgery refraction was + 10.75, while post-surgery + 1.25. Average best-corrected visual acuity in Snellen charts before surgery was 0.3 and at the end of the observation period 0.5. The improvement in visual acuity after surgery in relation to visual acuity before surgery was

statistically significant ( $P = 0.005$ ). In the first 2 weeks after surgery, minor hypotonia was observed in three of the patients, while in two—moderate bleeding to the vitreous body and the anterior chamber, which subsided without surgical intervention. A slight decentration of the implant observed in two cases did not affect later refraction or BCVA.

**Conclusion** Basing on the abovementioned facts, we believe that this surgical approach facilitates the fixation of the dislocated lens and allows a successful treatment of secondary implantation or repositioning of a dislocated intraocular lens.

**Keywords** Transscleral fixation · Post-traumatic aphakia · Vitrectomy

## Introduction

Eye injuries are one of the main reasons for severe visual impairment. Eighteen million people worldwide have unocular blindness caused by traumatic injury [1]. According to Kuhn, eye injuries could be classified as closed-globe or open-globe injuries. Closed-globe injuries are more common than open-globe ones; however, the latter have poorer visual outcome [2]. 9% of blunt eye injuries result in the dislocation of the natural lens or of the intraocular lens (IOL) implant to the vitreous body chamber or to the anterior chamber [3].

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In post-traumatic eyes with lens subluxation or its dislocation to the vitreous body chamber, a remedial surgery should be performed with the method of phacoemulsification, extracapsular or intracapsular extraction of the lens, as well as lensectomy during pars plana vitrectomy [4]. Choice of the surgical approach depends both on the local condition of the eye, and surgeons expertise or preference.

In case of dislocation of the lens into the vitreous body chamber, pars plana vitrectomy is a method of choice. Depending on the hardness of the lens, a vitrectome or a phaco fragmatome is used. The latter is dedicated to harder lens, which require the use of ultrasounds [3, 4].

After a successful removal of the lens, further optical correction is important, achieved usually through introducing an intraocular implant. If no sufficient support from the lens capsules is provided, the IOL can be implanted in the anterior chamber, fixated to the iris (the iris claw type) or implanted in the posterior chamber and fixed with scleral sutures [5–13].

In our study, in post-traumatic eyes, after vitrectomy performed as the first stage of the surgery, we used the technique devised by Scharioth, that is non-suture fixation of posterior chamber implant in the area of the groove, in which haptics are placed in scleral tunnels parallel to the corneal limbus [14]. This technique combines a high degree of intraoperative control of the implant and its good postoperative axial stability. Even though it was devised as a method of secondary lens implantation, it can also be modified, and used in case of the IOL luxation or the whole capsule/lens complex [14]. In our work, we evaluate the outcome of this technique on a group of 15 patients treated in our hospital.

## Materials and methods

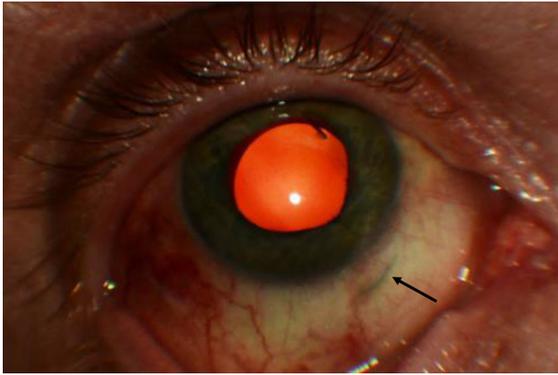
The retrospective study included 15 patients from the department of Vitreoretinal Surgery operated in the years 2013–2015. All cases concerned ocular traumas with dislocation of the natural or artificial lens to the anterior chamber, vitreous body chamber, or post-traumatic aphakia. Immediately after vitrectomy, patients had the implant surgically fixated by one of two surgeons with the use of the abovementioned technique. Informed consent was obtained from every

patient before surgery. Preoperative (best-corrected visual acuity, refraction errors, co-existing eye conditions, biometrics using IOL Master 500 combined with Tomey Casia SS-1000) and postoperative condition (slit-lamp examination with IOL centration assessment) was evaluated in all the patients; potential complications and secondary surgeries, if needed, were recorded.

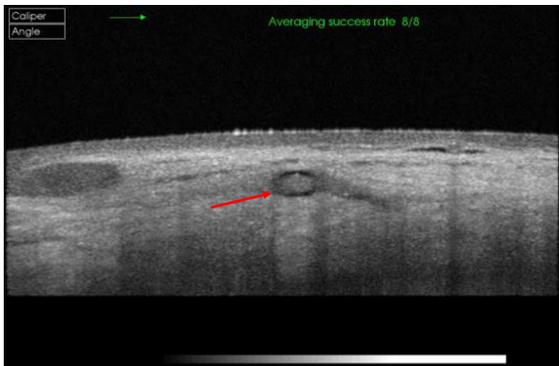
## Surgical technique

Standard 20 or 23 gauge pars plana vitrectomy was performed as a first step. Following, two straight sclerotomies with a 25 gauge knife, ab externo, 1.8–2 mm from the corneal limbus, exactly 180° from one another were performed. Subsequently, intrascleral tunnels were created with a 27Gx1" injection needle, of a depth of about 30% of the thickness of the sclera, beginning near to the sclerotomy in the plan view of the ciliary body sulcus, and parallel to the limbus at the length of 2–3 mm. Cannulae were introduced into the tunnels in order to facilitate the fixation of the haptics. Following previous IOL explantation, a standard 3-part Alcon MA60AC lens with haptics designed for a full diameter of the ciliary body sulcus was implanted with an injector through a clear corneal tunnel, with haptic fixed in it. The front haptic was held at the end with vitrectomy 25 gauge forceps, pulled out through the sclerotomy and introduced into the cannula in the corneal tunnel. Analogously, the rear haptic was held with 25 gauge forceps, pulled out through the sclerotomy and then introduced into the corneal tunnel in order to center the lens. Subsequently, cannulae were removed from the corneal tunnels, while the haptic parts of the lens remained there. The intracorneal tunnels were long enough to leave the distal parts of the haptics hidden in them in order to prevent the sensation of a foreign body in the eye, erosion of the conjunctiva and to reduce inflammation (Fig. 1). The location of IOL haptic in anterior segment OCT is shown in Fig. 2.

All cases were performed by one experienced surgeon, who previously has performed about 300 standard secondary IOL fixations with various techniques. Probably due to this, the learning curve was quite steep, with surgeons subjective feeling of fluent transition from standard techniques, being quite confident with surgical maneuvers just after 3rd procedure.



**Fig. 1** One month postoperative slit-lamp image of the limbal position above the scleral tunnel. The PC IOL haptic (arrow) is completely incarcerated in the scleral tunnel



**Fig. 2** Anterior segment OCT image shows the scleral tunnel with the incarcerated haptic of the PC IOL at 6 weeks (red arrow)

### Statistical analysis

The average visual acuity was determined with Snellen scale. The changes in visual acuity were compared using Wilcoxon test.

### Results

The studied population consisted of 15 persons (12 men and 3 women), with average age of 63 (36–78). Table 1 lists preoperative eye conditions, the most frequent of which was post-traumatic aphakia and the dislocation of the natural lens or of the implant to the vitreous body chamber. An average follow-up was 29 weeks.

Table 2 lists postoperative complications, all occurred within the first 2 weeks after the surgery.

The cases of minor hypotonia or bleeding to the vitreous body or the anterior chamber subsided within 1 week without surgical intervention. A slight decentration of the implant observed in two cases did not affect final refraction or BCVA. No case of inflammation in the anterior or posterior chamber was observed. No postoperative complications affected final visual acuity. Table 3 presents refraction and visual acuity (BCVA). The improvement in visual acuity after surgery in relation to visual acuity before surgery was statistically significant ( $P = 0.005$ ).

### Discussion

There are many approaches of tackling dislocation of the intraocular lens. These include repositioning the lens to the groove or to the anterior chamber through the pars plana [15, 16], exchange of the lens [15, 17, 18], ciliary sulcus fixation of the lens [7, 11, 19, 20] or fixation to the iris [21, 22]. Placing sutures around the haptic parts of the dislocated lens via an internal approach often requires complicated intraocular maneuvers. Moreover, numerous surgical techniques consist of fixing the haptics of the lens with the loop of the suture instead of tying the sutures on the haptics, which might increase the probability of the suture slipping off the haptic during or after the surgery [18, 23]. Two-point fixation of the suture increases the risk of the axial tilt of the lens, while three or four point fixation of the lens increases the risk of complications caused by intraocular manipulations. Our technique differs from other non-suture methods [24, 25] in that we use a scleral tunnel of a small diameter, which minimizes surgical manipulations and traumatization of the sclera. A small-diameter tunnel can prevent leakage from the wound, providing excellent lens stability, and short tissue healing time. This was confirmed in the postoperative OCT study (Fig. 2). The photograph presents total adhesion of the haptic within the scleral tunnel and proper integrity of the incision 6 weeks after the surgery. No signs of leakage or inflammation were observed.

In the technique we used, secondary implantation or refixation of dislocated artificial lens by fixing it with the use of scleral tunnels is technically less demanding, as the IOL is stabilized in the posterior chamber without the need of employing difficult suturing techniques. The risk of distortion and

**Table 1** Preoperative eye conditions

Patient no. <i>N</i> = 15	Age	Sex	Medical history	Plastic of the iris
1	59	M	Blunt trauma	+
2	73	F	Blunt trauma, retinal detachment	–
3	75	M	Blunt trauma, PC IOL vitreous luxation	–
4	64	F	Blunt trauma	+
5	64	M	Blunt trauma	–
6	36	M	Blunt trauma, globe rupture	+
7	64	M	Blunt trauma	+
8	68	M	Blunt trauma, retinal detachment	–
9	43	M	Perforation of the eyeball	–
10	76	M	Blunt trauma	–
11	58	M	Blunt trauma	–
12	78	M	Blunt trauma	–
13	56	F	Blunt trauma, PC IOL vitreous luxation	–
14	66	M	Blunt trauma	–
15	56	M	Blunt trauma, PC IOL anterior chamber luxation	–

*PC IOL* posterior chamber intraocular lens

**Table 2** Postoperative conditions

Postoperative complications	<i>n</i> (%)
Minor IOL dislocation	2 (13,3)
Smooth hemorrhage	2 (13,3)
Persistent hypotony (< 8 mmHg)	3 (20)

**Table 3** Visual acuity pre- and postoperatively

Parameter	Preoperative	Postoperative
Median SE refraction (Dsph)	10.75	1.25
<i>BCVA</i> ( <i>Snellen</i> )		
Mean	0.3	0.5
0.5 or better, <i>n</i> (%)	5 (33.3)	7 (46.7)
0.1–0.4, <i>n</i> (%)	9 (60)	8 (53.3)
0.1 or worse (%)	1 (6.7)	–
<i>Change in BCVA, n</i> (%)		
Gained 2 or more lines	–	5 (33.3)
± 1 line of prop value	–	9 (60)
Lost 2 or more lines	–	1 (6.7)

*BCVA* best-corrected visual acuity, *SE* spherical equivalent

decentration of a posterior chamber lens can be minimized by placing the haptics precisely in the scleral tunnels located above the ciliary body sulcus.

In order to avoid tilting of the lens, the implanted three-part lens should be equipped with haptics designed for the entire diameter of the ciliary body sulcus. The ingrowth of the distal parts of both haptics stabilizes the lens in the axial plane, which should minimize the occurrence of its in long-time follow-up. Due to the possibility of the haptics location adjustment in the sclera during surgery, the lens can be properly centered.

Long-term evaluation of the results of the study has demonstrated that this method has met our preliminary expectations. The possible complications of the IOL scleral fixation in the posterior chamber using suturing techniques include suture-caused erosion, suture exposition, and recurrent IOL dislocation caused by suture rupture [26]. All of those can be avoided by employing the non-suture technique of fixation.

The occurrence of lens tilting or decentering after using the method of fixation by suturing in the ciliary body sulcus in other studies [12, 15, 17–19] was 0–17%, while in the method of intrascleral fixation—up to about 3.5% [14, 20].

Some techniques of secondary implantation with the suturing of the lens in the scleral pockets require at least two scleral sutures for each haptic. This creates a double risk of complications: potentially dangerous bleeding and intraocular inflammation by creating an “open gate” for infection. Numerous studies have proven that scleral suturing with the fixation of the

implant in the ciliary body sulcus via both an external and internal approach results in the fixation of the lens forwards or backwards from the sulcus. Long-term contact of the haptic with the choroid can increase the risk of the uveitis-glaucoma-hemorrhage syndrome [27].

Our technique minimizes the contact between the haptic and the choroid, which reduces the risk of UGH syndrome.

Scleral tunnels are well known in the surgery of the eye and unless there were previous cases of sclera inflammation (scleritis, episcleritis, rheumatoid arthritis, ophthalmic zoster), scleromalacia is not expected to occur [28, 29].

The ends of the haptics are hidden, and so far conjunctival erosion has not been observed in any of the eyes. The risk of chronic inflammation or recurrent bleeding is smaller than in other techniques of fixation to the groove due to the minimal contact of the haptic with the choroid.

Stiff haptics, apart from causing serious difficulties during implantation, can cause decentration of the implant as a result of an injury or even rubbing the eye, etc. Therefore, we recommend avoiding one-part PMMA lenses for this technique. In case of a delicate connection between optics and haptics, as it is the case in Acrysof MA60 lens, this junction can be later broken as a result of an injury, but a longer follow-up period is necessary. Moreover, the technique we used was designed for a standard three-part lens and is not suitable for a one-part silicon or acrylic lens. In spite of the fact that the eyes in our study had complex preoperative conditions and some postoperative complications occurred, average postoperative corrected distance visual acuity was statistically significantly better than before the surgery ( $P = 0.005$ ). After 7 months of observation on average, there were no cases of decentration or other serious complications.

Basing on the above analysis, we believe that the surgical technique we use simplifies the fixation of a dislocated lens and allows a successful secondary implantation or repositioning of a dislocated intraocular lens. Moreover, our technique reduces the number of surgical maneuvers, which can reduce the risk of surgical traumatization, and by using foldable lens, postoperative astigmatism is minimal.

## Compliance with ethical standards

**Conflict of interest** All authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

**Ethical approval** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee (name the institution/committee) and with the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards. For this type of study, formal consent is not required.

**Informed consent** Informed consent was obtained from all individual participants included in the study.

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