Phakic iris-claw IOL implantation, with Bursa technique, through a self-sealing scleral tunnel and without iridotomy or iridectomy

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PURPOSE. *To present a novel technique for the implantation of phakic iris-claw intraocular lenses (IOL) in highly myopic cases.*
METHODS. *Twelve cases, under the age of 40, with high myopia were included in this retrospective study. The mean follow-up span was 14.4±5.8 months. Phakic iris-claw IOL implantation was performed, through a 5.5 or 6.5 mm self sealing scleral tunnel with Bursa technique. No suturing and opening a peripheral iridectomy or iridotomy was required in our study. Pre- and postoperative patient evaluation included manifest and cycloplegic refractions, uncorrected visual acuity, best-corrected visual acuity (BCVA), induced astigmatism, and intraocular pressure (IOP) assessments.*
RESULTS. *All eyes gained one to nine lines of BCVA of the Snellen chart. The vector analysis revealed an induced astigmatism of 0.63 D. No significant IOP change was detected throughout the follow-up.*
CONCLUSIONS. *The data suggest that nonfoldable iris fixated phakic IOL implantation, through a self-sealing incision with Bursa technique, is safe and requires no iridectomy or iridotomy in cases with deep anterior chambers. (Eur J Ophthalmol 2009; 19: 18-23)*

KEY WORDS. *Bursa technique, Implantation, Iris-claw IOL, Phakic, Myopia*

Accepted: June 8, 2008

INTRODUCTION

Iris-claw intraocular lens (IOL) was primarily developed by Worst for aphakic cases in 1978 (1). By 1986, the initial model was modified to a negative-powered biconcave lens to be used in highly myopic phakic cases. In 1991, the optic design of the IOL was changed to an anterior convex and posterior concave shape, and named the Worst myopia lens. In the late 1990s, after slight changes in the optic diameter, the brand name of the lens was altered to Artisan myopia lens. By 2004, the Food and Drug Administration permitted the use of the latter in the United States, with the trademark Verisyse (2). A year later, the first foldable iris-claw IOL, Artiflex/Veriflex, was put on the market. The lens has a soft silicone optic with rigid polymethylmethacrylate haptics and can be inserted through a 3.2 mm incision (3).

Usually, hard phakic iris-claw IOLs are implanted through an anterior limbal incision. During the standard procedure, a peripheral iridectomy (PI) is created after the lens is fixed to the iris. Still, some authors prefer to open a YAG iridotomy preoperatively so to prevent pupillary blockage (4, 5). The procedure is concluded as the incision is sutured. However, in our “Bursa technique,” phakic iris-claw IOL is implanted through a self-sealing scleral tunnel. In cases with deep anterior chambers (Acs) (depth over 3 mm), a PI or iridotomy is not performed (Fig. 1).
Flexible iris-claw IOL implantation in phakic cases is a rather new technique and long term results have not been published. Hard phakic iris-claw lens implantation is still a widely accepted and frequently used means to correct high myopia, especially in developing countries. Herein, we present a novel technique of implanting hard phakic iris-claw IOLs and discuss its possible advantages.

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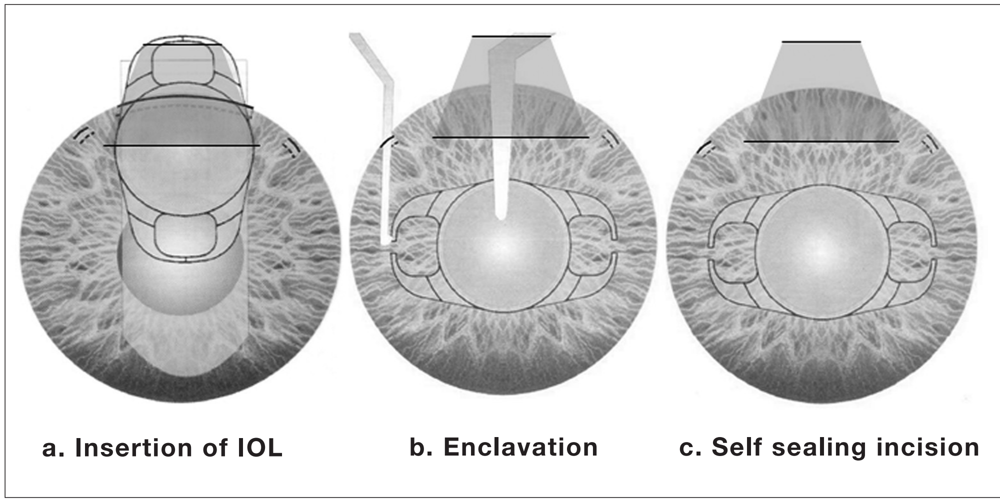

Fig. 1 - *Bursa technique (a self sealing scleral tunnel with no peripheric iridectomy or suture).*

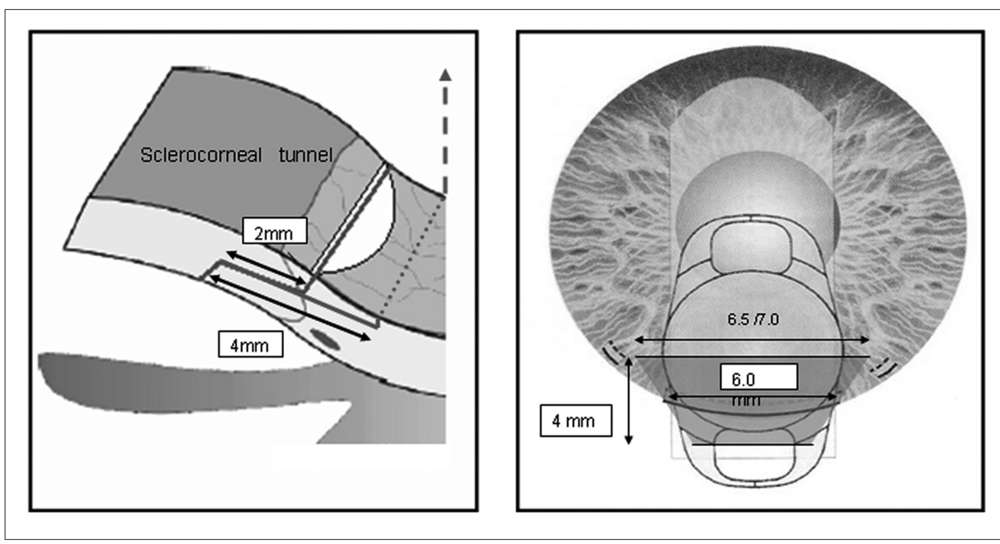

Fig. 2 - *Self sealing scleral tunnel incision and the position of iris claw intraocular lens in the tunnel in bursa technique.*

METHODS

Twelve eyes of seven healthy patients (four female, three male) were included in this retrospective study within 24 months. Inclusion criteria required that the cases were younger than 40 years old and the spherical equivalent of refractive errors were higher than −10.0 diopters (D). The mean age of the cases was 29.5±4.07 (24–38). Cases with shallow ACs (depth less than 3.0 mm) were excluded. The study was carried out with the approval of the local ethics committee and each case provided a written informed consent. The mean follow-up period was 14.4±5.8 months (3–24 months).

Each study participant underwent a complete ophthalmologic examination including manifest and cycloplegic refractions, uncorrected visual acuity (UCVA), best-corrected visual acuity assessments (BCVA), and IOP measurements with Goldmann applanation tonometer (Haag-Streit, Koeniz, Switzerland). Subsequently, an anterior segment biometry comprising central corneal thickness (CCT) and AC depth was performed with Pentacam (Oculus, Wetzlar, Germany). Appropriate IOL power was calculated with the van der Heijde formula. An optic diameter of 6 mm was preferred if the power was under 15.5 D; however, in higher powers, implanting an IOL with an optic diameter of 5 mm was unavoidable since there is no other manufactured option.

In our technique, pilocarpine 2% is given preoperatively to achieve miosis. Type of the anesthesia to be given depends on whether both eyes will be operated at a time. In

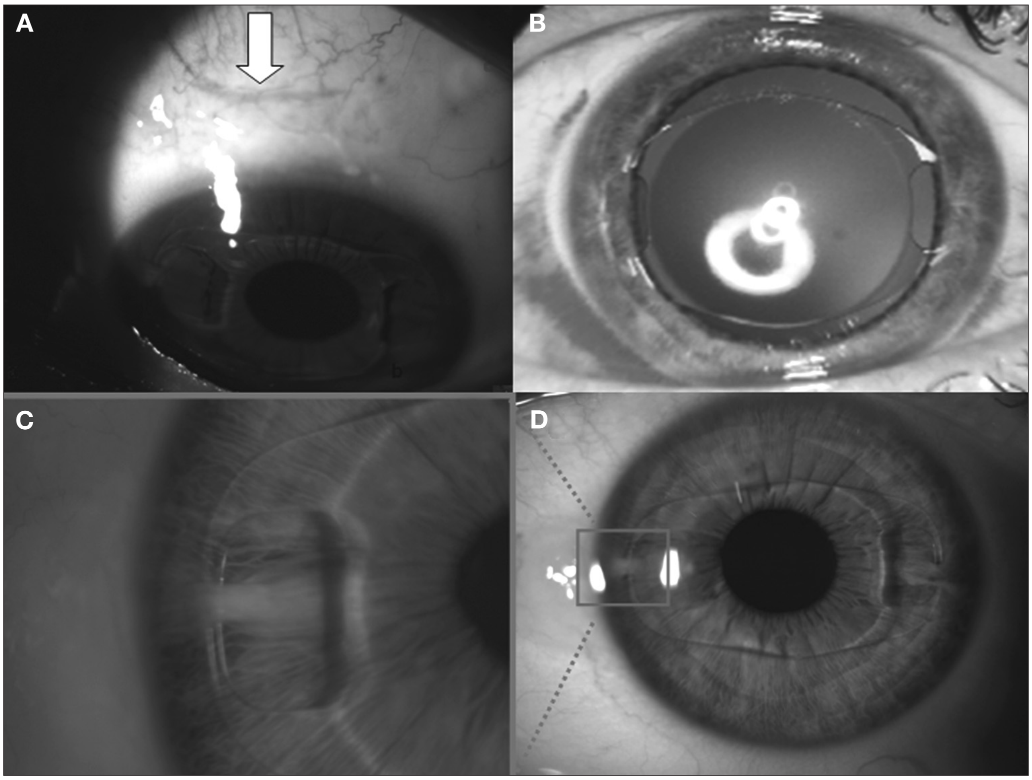

Fig. 3 - (A) *Scleral tunnel.* **(B)** *Dilated pupil.* **(C, D)** *Enclavation sites of our technique.*

our study, eight eyes of four cases were operated at a session, under general anesthesia, and the rest were operated with peribulbar anesthesia. Initially a fornix based conjunctival flap is created, then a superior scleral tunnel incision and a self-sealing scleral tunnel is performed 0.5 mm larger than the optic diameter. Subsequently two stab incisions are opened through the cornea at 2 o'clock and 10 o'clock positions. After injecting acetylcholine and a viscocohesive viscoelastic, IOL is fixed to the iris at 3 o'clock and 9 o'clock positions. In the first seven cases, Artisan lens was implanted whereas Verisyse lens was used in the following. In Bursa technique, suturing is unnecessary and if the AC is deep enough, a PI or iridotomy is optional since it is needleless (Figs. 1-3). After aspirating the viscoelastic and hydrating the sideports, the conjunctiva is closed with a hand cautery and the procedure is concluded.

In this pilot study; all cases were evaluated on the first postoperative day, the first week, the first month, and the third month. SPSS 13.0 (SPSS Inc., Chicago, IL, USA) statistical program was used for all statistical analyses, and p values less than 0.05 were considered statistically significant for all analyses. Wilcoxon methods were used to interpret the data.

RESULTS

In the preoperative evaluation, the mean CCT was 545±39.08 (515–612) μm and the AC depth was 3.16±0.09 (3.03–3.24) mm with Pentacam. The mean spherical equivalent of the refractive error was –17.5±5.3 D (–10.0 D to –24.5 D) preoperatively, whereas it was –0.92±0.44 D (–0.5 D to –2.0 D) postoperatively (Tab. I). Mean astigmatism was reduced from 1.32 D±0.65 to 0.40±1.52 D postoperatively. Induced astigmatism with vector analysis was 0.63 D. Preoperative and postoperative UCVA assessments with the Snellen chart were 0.05±0.1 D and 0.3±0.24 D, respectively, which represents a statistically significant difference ($p<0.05$). Besides, preoperative and postoperative BCVA assessments with the Snellen chart were 0.31±0.25 D and 0.58±0.31 D, respectively. All eyes gained one to nine lines of BCVA on the Snellen chart. The difference was statistically significant ($p<0.05$) as well. The mean preoperative IOP reading was 13.3±1.8 mmHg whereas it was 14.0±2.2 mmHg postoperatively. The difference was not statistically significant ($p>0.05$).

No potentially sight-threatening complications such as IOL luxation, corneal edema, pupillary block, iris atrophy,

TABLE I - DETAILS OF HARD PHAKIC IRIS CLAW IOL IMPLANTATION WITH BURSA TECHNIQUE (self sealing scleral tunnel incision, without PI and suture)

Case/age, yr	Eye	Preoperative				IOL	Postoperative			
		Spherical	Cylindrical	BCVA	IOP		Spherical	Cylindrical	BCVA	IOP
1 RK/30	OD	–13.0	–2.00 × 88	0.1	12.0	–11.0/6.0/8.5	+0.75	–3.25 × 3	0.15	13.0
2 AA/30	OD	–13.0	–2.00 × 70	0.2	13.0	–13.0/6.0/8.5	–1.75	–0.75 × 98	0.2	13.0
3 AA/30	OS	–14.0	–1.00 × 85	0.1	12.0	–14.0/6.0/8.5	+0.50	–2.75 × 82	0.2	14.0
4 HC/24	OD	–9.50	–0.75 × 166	0.8	16.0	–10.0/6.0/8.5	_	–2.00 × 128	0.7	12.0
5 HC/24	OS	–11.50	–1.25 × 8	0.6	16.0	–12.0/6,0/8.5	_	–1.00 × 98	0.7	18.0
6 SD/33	OD	–23.0	_	0.1	12.0	–25.0/5.5/8.5	–0.75	_	1.0	13.0
7 SD/33	OS	–23.0	–2.00 × 75	0.2	13.0	–25.0/5.5/8.5		–1.00 × 180	1.0	13.0
8 FT/38	OS	–24.00	–1.00 × 74	0.1	10.0	–23.0/5.5/8.5	–1.00	–0.50 × 14	0.5	12.0
9 AB/26	OD	–19.50	–1.75 × 83	0.5	15.0	–17.50/5.5/8.5	_	–1.00 × 80	0.8	16.0
10 AB/26	OS	–18.50	–1.50 ×152	0.4	15.0	–17.50/5.5/8.5	_	–1.50 × 110	0.9	15.0
11 OC/30	OD	–12.00	–1.0 × 81	0.5	12.0	–11.0/5.0/8.5	–1.00	_	0.3	12.0
12 OC/30	OS	–11.25	–2.0 × 102	0.4	14.0	–11.0/5.0/8.5	–1.00	–1.50 × 20	0.3	14.0

IOL = intraocular lens; BCVA = best-corrected visual acuity; IOP = intraocular pressure.

TABLE II - COMPARISON OF DIFFERENT IMPLANTATION TECHNIQUES FOR HARD IRIS-CLAW IOL

Methods	Site of incision	Presence of PI	Presence of suture	Induced astigmatism	Suture removal	Visual disturbance	Patient satisfaction
Conventional	SAL	(+)	(+)	–0.84±0.85	(+)	(+)	(+)
Kruemich	SSC	(+)	(+)	–0.50/–2.5	(+)	(+)	(++)
Dick/Sekundo	TSC	(+)	(+)	–0.75	(+)	(–)	(+++)
Tehrani/Dick	SSC	(+)	(–)	–1.15±1.01	(–)	(–)	(+++)
Bursa	SST	(–)	(–)	0.63	(–)	(–)	(++++)

IOL = intraocular lens; SAL = superior anterior limbal incision; SSC = superior sclerocorneal incision; TSC = temporal sclerocorneal incision; SST = superior scleral tunnel incision.

retinal detachment, endophthalmitis, or glaucoma were recorded peroperatively or postoperatively (Fig. 3).

DISCUSSION

Phakic IOL implantation is a significant milestone in the history of refractive surgery. It is still a viable treatment option especially for young individuals and carries no risk of corneal ectasia. In past decades, much development has taken place in this field and attempts have evolved to refine surgical technique.

The conventional hard phakic iris-claw implantation technique is susceptible to renovation. In the standard procedure, IOL implantation is managed through an anterior limbal corneal incision and a PI is performed subsequently. Some authors may prefer to open a YAG iridotomy before the procedure instead (4, 5). The most frequently reported complication with the conventional technique is the induced astigmatism secondary to incision site. Other complications include progressive pigment dispersion and secondary glaucoma (5, 6).

In order to avoid induced astigmatism, diverse incision techniques and incision sites have been studied (2, 7, 8) (Tab. II). Sekundo et al stated that suturing scleral tunnel

TABLE III - INCISION TECHNIQUE FOR ASTIGMATIC NEUTRALIZATION DURING HARD IRIS-CLAW IOL IMPLANTATION (SEKUNDO/DICK)

Amount of astigmatism	Neutralizing incision
1.0 diopters cyl	Superior sclerocorneal incision
1.5 diopters cyl	Superior corneal incision
2.5 diopters cyl	Superior corneal incision + LRI at 6 o'clock

IOL = intraocular lens.

superiorly reduces the amount of astigmatism whereas Kruemich et al emphasized that preplacing sutures is favorable (7, 9) (Fig. 3) (Tab. III).

Our Bursa technique is based on the principles of mini-nucleus cataract extraction. Previous studies acknowledge that scleral tunnel incisions of 5.5 to 6.5 mm induce an astigmatism of 1 to 1.5 D in this method (10-12). The vectorial analysis outcome in our study (0.63 D) is in concordance with the previous reports. Table III gives a summary of diverse implantation techniques for hard iris-claw IOLs.

During the standard procedure, surgical trauma and prolonged contact with the trabecular meshwork and iris cause subsequent inflammatory reaction. Additionally, discharge of the iris pigments after implantation lead to pigmentary dispersion syndrome (PDS) glaucoma (13, 14). By virtue of our technique, contact with iris and inflammation is minimized, thus the incidence of PDS glaucoma is decreased. In the present study, no case of PDS occurred.

Another major issue with the conventional technique is the necessity of PI and its relevance with secondary glaucoma. In phakic IOL implantations, IOP elevation is one of the most feared complications. Alterations in IOP happen, either when the physiologic flow of aqueous is obstructed by the IOL or when the IOL forces the iris-lens diaphragm forward and closes the iridocorneal angle. It has been reported that pupillary blockage is more likely to occur after posterior chamber phakic IOL implantations (15). We consider that the unique anterior convex and posterior concave shape of iris-claw IOL allows the aqueous to flow easily between the chambers and a properly implanted IOL has no effect on the iris-lens diaphragm. Although an iridotomy with YAG laser preoperatively or a surgically intervened iridectomy is strongly recommended, we have performed neither of them, especially in cases with deep AC (1-4, 6, 9). In our follow-up ranging from 3 to 24 months, no significant IOP elevation has been recorded. Thus, in our technique, if the AC is deep enough an iridotomy with YAG laser preoperatively or a peroperatively performed iridectomy should be optional rather than obligatory. Still, IOP should be closely monitored in such cases.

In conclusion, hard phakic iris-claw IOL implantation is frequently used in developing countries for highly myopic cases. Bursa technique can be evaluated as a refinement of the conventional surgical technique and offers some advantages, e.g., reduction of both induced astigmatism and pigment dispersion. In selected cases, an extra burden of opening a YAG iridotomy preoperatively or a peroperative intervention to open a PI is eliminated with this technique. Further studies are required to validate this initial observation.

The authors have no proprietary interest in this study.

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