Original Article

Modified Technique of Four Point Scleral Sutured Posterior Chamber Intraocular Lens Without Scleral Flaps

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Purpose: To report the visual outcome, safety and complication profile of four point scleral sutured posterior chamber intraocular lens without sclera flaps.

Material and Methods: This prospective interventional study comprised 21 eyes of 21 aphakic patients who were admitted in Ophthalmology ward of Jinnah Hospital Lahore from April 2010 to August 2011 for secondary intraocular lens implantation using four point scleral fixation technique. Three follow up visits were scheduled starting at 1st post operative day, 1st and 5th post operative months.

Results: Twenty one eyes of 21 patients, 12 male and 9 female, underwent four point scleral fixation of posterior chamber intraocular lens with custom modification in intraocular lens design. At 5th month follow up, 18 patients had Best Corrected Visual Acuity of 6/12 or better. Two patients had cystoid macular edema and one had tilted intraocular lens. No patient had any sign of suture erosion, elevated intraocular pressure or intraoperative bleeding.

Conclusion: Four point scleral fixation without scleral flaps is a safe technique of intraocular lens implantation in aphakic patients.

Posterior capsular (PC) rupture is one of the most frequent complications during phacoemulsification surgery[1]. Visual rehabilitation of an aphakic eye becomes a challenging situation for the surgeon. Common therapeutic options available for such a situation include aphakic spectacles, contact lenses, anterior chamber intraocular lens (AC IOL), scleral fixated posterior chamber intraocular lens (PC IOL) and refractive corneal surgery[2]. In patients with bilateral aphakia, aphakic spectacles remain safest and most cost effective solution but patients are optically intolerant to aphakic spectacles[3]. Contact lens is a better optical solution for aphakia but intolerance, care and cost pose a significant problem to patients of middle and late age groups in our setup. AC IOLs provide a quick and readily available answer to aphakia, but they have been associated with a myriad of complications like glaucoma secondary to angle damage and pupil block, hyphaema, pigment dispersion and persistent anterior uveitis[4].

Scleral fixation of PC IOL is a suitable option for aphakic patients who are optically dissatisfied with aphakic spectacles and for those who cannot undergo expensive refractive surgery.

Scleral fixation of PC IOL was first reported by Girard[5] in 1981 and then was later improved on by Malbran[6] and colleagues in 1986. American Academy of Ophthalmology sponsored report by Wagoner and colleagues concluded that scleral fixation of PC IOL is a safe and effective technique in adults with aphakia with minimal or no capsular support[7].

Major problems with scleral fixation include tilting of intraocular lens (IOL) and questionable long life of the suture material used. Four point scleral fixation of

PC IOL is a novel technique for correction of aphakia in children and adults[8]. Recently Almashad and colleagues conducted a case series of four point scleral fixation of PC IOL without scleral flaps and concluded that this technique reduces the operation time, achieves good centration and stability of the IOL, and minimizes postoperative suture – related complications[8].

We conducted a similar case series utilizing recommended surgical steps of four point scleral fixation with few modifications regarding the IOL.

MATERIAL AND METHODS

This prospective interventional study was conducted in Ophthalmology department of Jinnah Hospital Lahore from April 2010 to August 2011. Twenty one aphakic patients were enrolled for four point scleral fixation of PC IOL after meeting the inclusion and exclusion criteria. Inclusion criteria consisted of following: improvement of best corrected visual acuity to ≥ 6/36, age more than 50 years, patients unable to or intolerant to contact lens and aphakic spectacles, no significant anterior segment structural abnormality and no active uveitis. Patients were excluded from the study based on the following criteria: patients with only eye, active or old vitreoretinal pathology threatening to compromise immediate and long term visual results of this surgery, patients with diabetic clinically significant macular edema, patients with cystoid macular edema and patients with active adnexal diseases like blephritis or nasolacrimal duct pathologies. An informed consent was obtained where all risks and benefits of this procedure were explained to patients. Approval from hospital's ethical committee was officially sought.

Patients were recruited from the outpatient patient department (OPD) after undergoing complete ocular and systemic evaluation including best corrected visual acuity, intraocular pressure measurement, complete anterior and posterior segment evaluation using slit lamp and indirect ophthalmoscopy. A detailed medical history was taken to rule out uncontrolled diabetes, hypertension, asthma, orthopnea and history of seizures and tremors.

Broad spectrum topical antibiotic was started 1 day before surgery. Biometry was performed using Ocuscan by Alcon (Fort worth, Texas).

All surgeries were performed by a single surgeon under local anesthesia. Local anesthesia consisted to equal proportion mixture of Lignocaine 2% and Bupivacaine 0.5%.

Surgical Technique

Patients were prepared and draped following standard protocols for routine cataract surgery ensuring instillation of 5% Povidone Iodine on ocular surface and fornices for 3 minutes. Limited anterior vitrectomy was performed for removal of vitreous from anterior chamber, pupillary plane and from the plane of posterior chamber (anticipated location of IOL placement). Limited conjunctival peritomy centered at 1:30 and 7:30 clock hours was performed. Hemostasis on scleral bed was achieved through bipolar wet field cautry. 3mm long partial thickness (2/3 scleral depth) scleral grooves were made at 1:30 and 7:30 clock hours using 15° phaco knife. These scleral grooves were positioned exactly 0.75mm behind posterior surgical limbus to avoid damage to vascular portion of ciliary body (Fig 1a). A 10° bent tip 27 gauge needle was passed vertically down from one edge of 7:30 clock hour scleral groove. A 10/0 prolene suture with straight needle was passed vertically into posterior chamber half way through its length 180° opposite to 27 gauge needle; using 1:30 clock hour scleral groove (Fig 1b). 10/0 prolene needle was engaged in the lumen of 27 gauge needle and 27 gauge needle was carefully withdrawn (Fig 1c). This resulted in a single strand of 10/0 prolene spanning from 1:30 to 7:30 clock hours in the posterior iris plane (Fig 2a). The bent tip of 27 gauge needle ensured that 10/0 prolene needle does not slip out during its withdrawal from the globe. Special attention was paid not to damage any intraocular structures during these maneuvers including iris, ciliary body and retina. An identical procedure was repeated from the other end of both scleral grooves (Fig 2b). Now we had 2 strands of 10/0 prolene spanning the posterior iris plane (Fig. 2c).

At this stage, 6.5 mm optic diameter PMMA intraocular lens was prepared to be tied to 10/0 prolene. The haptics of IOL were bent from their edges by a length of 1 mm using a squint hook heated on a spirit lamp (Fig 3b). This modification (Haroon's Technique) from standard technique was introduced to counter two issues. One, the lack of ready availability of standard scleral fixation IOLs in required powers. Secondly, to ensure the prolene knot does not slip from the haptic during postoperative period.

One strand of 10/0 prolene was retrieved using standard IOL dialer through a near clear corneal shelved incision (Fig 3a). After dividing the exteriorized 10/0 prolene into two equal halves, its ends were tied to the haptics of IOL (Fig 3b). Similar routine was repeated for the second strand of 10/0 prolene (Fig 3c). This time around, special care was taken not to entangle the sutures and ensure careful placement of sutures at their appropriate places on IOL haptics. Corneal incision was enlarged to 7mm using phaco knife and IOL was inserted in the eye while performing controlled tractions on the exposed edges of 10/0 prolene. Knots were tied resulting in complete burial 10/0 prolene in the scleral grooves (Fig 3d). Corneal incision was secured using 10/0 Ethilon and peritomies were closed using 6/0 Vicryl.

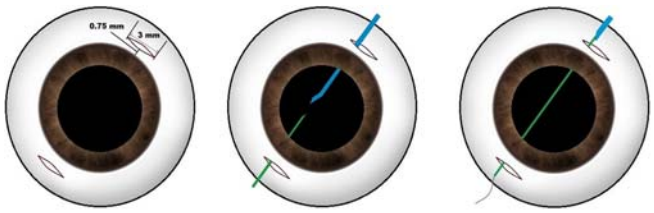
Patients were started on routine post operative topical and systemic medications and were discharged on the same day. They were called back on 1st post operative day and then 1st and 5th post operative month.

RESULTS

21 eyes of 21 patients underwent four point scleral fixation of PC IOL without scleral flaps during the mentioned period of this interventional study. All patients fell in the age range of 50 to 75 years with mean age of 63 years. 12 (57%) patients were male and 9 (43%) were female. 10 (48%) patients had their right eye operated while 11 (52%) patients had surgery done on their left eye. All of these patients had a primary complicated extra-capsular cataract extraction (ECCE) or phacoemulsification for age related cataracts resulting in minimal or no capsular support left, such that IOL could not be implanted at the time of primary surgery. Adequate time was given to all patients to recover from their primary complicated surgery before

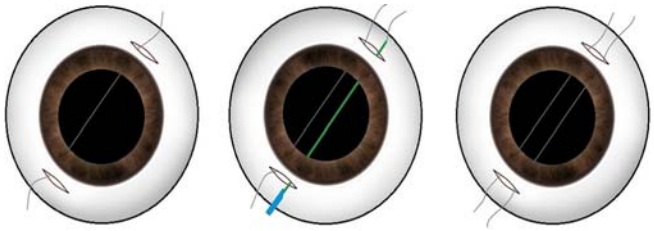
Table 1: Descriptive statistics and p-value of pre and post operative BCVA

	BCVA	
	6 / Mean	6 / Std. Deviation
BCVA (Pre-Op)	19.4286	8.41173
BCVA (1st day)	20.5714	6.72734
BCVA (1st Month)	14.1429	8.22366
BCVA (5 Month)	10.2857	7.44408
P-value	0.000 (significant change in BCVA)	



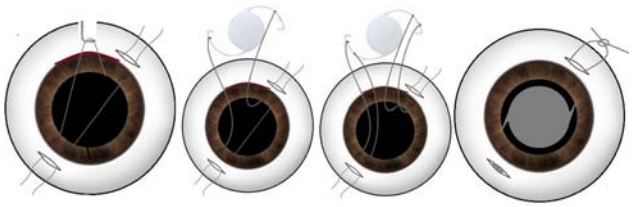
(a) **(b)** **(c)**

Fig 1: (a) shows 3 mm long partial thickness scleral grooves located 0.75mm away from surgical limbus. **(b)** shows entry of 10/0 prolene straight needle (Green) from 1:30 clock hour and 27 gauge needle (Blue) at 7:30 clock hour. **(c)** shows 10/0 prolene straight needle (Green) engaged in the lumen of 27 gauge needle (Blue) while the needle is being withdrawn from the globe.



(a) **(b)** **(c)**

Fig 2: (a) shows a single strand of 10/0 prolene suture spanning the peripupillary plane. **(b)** shows the second needle pass from the other end of scleral groove. **(c)** shows 2 strands of 10/0 prolene suture spanning the peripupillary plane.



(a) **(b)** **(c)** **(d)**

Fig 3: (a) shows one strand of 10/0 prolene being withdrawn from corneal incision with help of IOL dialer. **(b)** shows cut ends of prolene being tied to the haptics of IOL. It also shows that the edges of IOL haptics are bent 1mm from the ends. **(c)** shows 2 strand of 10/0 prolene suture being tied to the haptics. **(d)** shows implanted IOL in posterior chamber plane with 10/0 prolene knot securely buried in the scleral groove.

secondary IOL implantation was contemplated. Descriptive statistics are shown in Table 1.

Seven (33%) patients had pre operative best corrected visual acuity (BCVA) of 6/12 or better (Table 2). After 1st post operative month BCVA was 6/12 or better in 16 (76%) patients (Table 2). At the end of 5 month follow up, 18 (86%) patients had BCVA of 6/12 or better (Table 2). One patient (4.8%) had tilted IOL at 5 month post operative follow up and cause was identified to be inadequate anterior vitrectomy done at the time of scleral fixation. Two patients (9.5%) had cystoid macular edema (CMO) at 1 month follow up as shown in (Fig. 4).

Standard treatment was started for both patients; one patient responded to the treatment with improvement of BCVA at 5 month follow up to 6/18 partial. The other patient had BCVA of 6/24 at the end of 5 month follow up. The mean BVCA was statistically significant at the end of follow-up. There was no reported case of intraocular bleeding, suture related problems like suture erosion or exposed suture, persistent uveitis, pigment dispersion, raised intraocular pressure, pupil related complications or endophthalmitis. Fig. 5 shows the cumulative improvement in BCVA at the end of 5 months follow up.

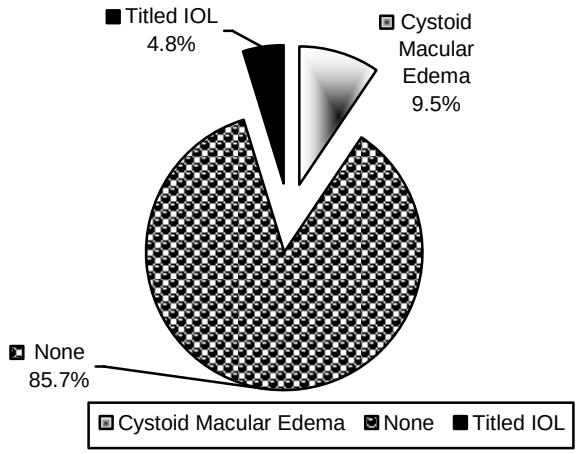


Fig. 4: Shows complication profile as of four point sclera fixation.

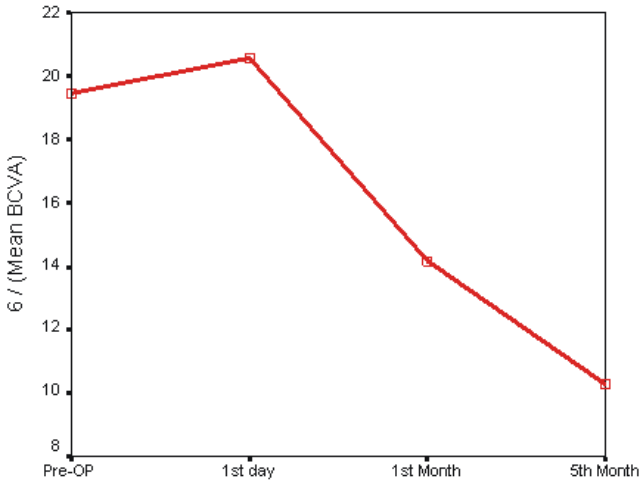


Fig. 5: Cumulative improvement in BCVA at 5 months.

DISCUSSION

Four point scleral fixation is a very safe and effective technique for visual rehabilitation in aphakic eyes having minimal or no capsular support. Recent studies have shown that four point scleral fixation significantly reduces the IOL tilt related problems.[8] Tong and colleagues showed that four point scleral fixation is an effective method to counter aphakia secondary to complicated globe trauma[10]. Almashad and his colleagues performed a case series of four point scleral fixation without scleral flaps. They utilized scleral grooves similar to that we described in our study and concluded that this technique significantly reduces surgical time, IOL tilt related problems and suture related problems like knot exposure and erosion[9]. The results of these two studies are comparable. A deep scleral groove allows for easy concealment of 10/0 prolene knots and four point fixation permits ease and simplicity of knot tying. A comparison of 4 point versus 2 point scleral fixation was conducted by Fass and colleagues. He concluded in his study that 4 point scleral fixation of PC IOL has lower chances of cystoid macular edema and pigment dispersion glaucoma as compared to 2 point fixation.[11] Our results were comparable to this study.

Most investigators prefer ciliary sulcus fixation but Apple and associates[12] have shown that posterior chamber IOL haptics often miss the sulcus and that the sulcus diameter is only 11.0 to 11.5 mm, less than most surgeons think. Duffey and associates[13] used needles perpendicular to the sclera to demonstrate scleral relationships to the ciliary sulcus and found that the sulcus lies only 1.0 mm posterior to the posterior surgical limbus in the vertical meridian and 0.5 mm behind the limbus in the horizontal meridian. In view of this, we placed sutures 0.75 mm posterior to the limbus in oblique meridians. Careful scleral location of needle entries maximized our chances for ciliary sulcus fixation and reducing the risk of bleeding from inadvertent perforation of the major arterial circle of the iris, which is located in the anterior ciliary body. Berler proposed that the only negative feature of this

Table 2: Shows pre operative and post operative BCVA at 1 day, 1 month and 5 months.

Sr #	Eye R/L	Age (Years)	Gender	Pre-op BCVA	Post-op BCVA 1st Day	Post-op BCVA 1st Month	Post-op BCVA 5th Month	Complications
1.	L	72	Male	6/36	6/36	6/18	6/9	None
2.	L	61	Male	6/24	6/18	6/9	6/12	None
3.	L	54	Female	6/18	6/24	6/12	6/9	None
4.	R	59	Male	6/18	6/12	6/9	6/6	None
5.	L	60	Female	6/24	6/24	6/24	6/24 p	**Tilted IOL**
6.	R	63	Male	6/24	6/12	6/9	6/9 p	None
7.	R	66	Female	6/12	6/18	6/12	6/6	None
8.	R	70	Female	6/12	6/18	6/12	6/6 p	None
9.	L	52	Male	6/9	6/18	6/9	6/6	None
10.	L	69	Male	6/9	6/36	6/24	6/18	**Cystoid Macular Edema**
11.	R	74	Female	6/18	6/18	6/9	6/6	None
12.	R	71	Female	6/18	6/24	6/12	6/9	None
13.	R	63	Female	6/12	6/24	6/12	6/9 p	None
14.	L	66	Male	6/36	6/24	6/9	6/12	None
15.	R	58	Male	6/24	6/18	6/9	6/6	None
16.	L	58	Male	6/36	6/18	6/12	6/6 p	None
17.	L	60	Female	6/18	6/12	6/9	6/6 p	None
18.	R	55	Male	6/12	6/12	6/9	6/6	None
19.	R	70	Female	6/12	6/24	6/18	6/6 p	None
20.	L	72	Male	6/18	6/24	6/36	6/6 p	**Cystoid Macular Edema**
21.	L	55	Male	6/18	6/18	6/12	6/9	None

technique is the initial confusion the surgeon faces when he has to handle 4 very delicate 10/0 prolene sutures coming out of the main incision site at the same time. But this initial problem is adequately handled with an experience of 1 or 2 cases and suture handling keeps on getting better with every case.

Due to meager availability of special IOLs designed for the sole purpose of scleral fixation, we were compelled to modify the haptics of a regular (6.5 mm optic diameter) polymethylmethacrylate (PMMA) IOL in such a fashion to minimize every chance of knot slippage from haptics in post operative period. This novel approach resulted in very satisfactory results for all the patients in this study. Four patients are in their second year of follow up with no complications like knot slippage, tilting of IOL and suture erosion.

Our results of post operative BCVA were comparable to Almashad[9] and Fass[11].

Follow up of our patients was brief (5 months) but

initial 5 months of uneventful recovery and extensive review of four point scleral fixation of PC IOL experienced by others in the literature suggested that no complications need be anticipated in the near or long term future.

We encourage the appropriate use of four point scleral fixation of PC IOL without scleral flaps and offer an alternate to custom made scleral fixation IOLs by proposing a very subtle modification of IOL haptics in above described fashion to avoid knot slippage. We offer an implantation technique that may prove beneficial in certain situations.

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