Original Article

Comparison of Iris Fixated and Scleral Fixated Intra Ocular Lens for Correction of Aphakia in Traumatic Cataract with no Proper Capsular Support

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Abstract

Purpose: To compare visual outcomes and complications of iris fixated and scleral fixated intra ocular lens (IOL) implantation in patients suffering from traumatic cataract with no proper capsular support.

Patients and Methods: This prospective interventional study was performed in Farabi Eye Hospital, Tehran, Iran, between May 2015 and May 2016. Twenty five patients with traumatic cataract and no proper capsular support for IOL implantation in the bag or sulcus were included and randomly underwent either iris fixated or sulcus fixated IOL implantation. Follow up visits were performed one day, one week, four weeks, three months and six months after surgery. In each visit visual acuity, intra ocular pressure, placement of IOL and anterior chamber reaction were studied.

Results: Thirteen eyes of 13 patients underwent iris fixation and 12 eyes of 12 patients underwent scleral fixation of IOL. The average patient age at presentation was 29.12 ± 16.32. In the follow up visit one week after IOL fixation three patients in each group had significant anterior chamber inflammation. There was no statistically significant difference between the two groups regarding the number of patients with elevated IOP (P = 0.96), dislocated IOL (P = 0.480) and complications such as wound dehiscence and iridocorneal adhesion. Also no statistically significant difference regarding the mean BCVA three months after surgery was observed (P = 0.55).

Conclusion: We did not observe any significant difference in outcome of iris and scleral fixation of IOL in traumatic eye injuries with no effective capsular support.

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Introduction

Ocular trauma is a leading cause of decreased vision and blindness. It can cause traumatic injuries to the orbit, lid, globe and its contents, optic nerve, and ocular adnexa. Lenticular injury is one of the most common causes of reduced vision in penetrating injuries [1,2]. Direct injury to the crystalline lens can occur through penetrating injury or blunt trauma of the globe [3]. Crystalline lens damage is found in 27 % to 65 % of ocular injuries [4-6].

Management of traumatic cataract is complicated because of associated injuries of cornea, sclera, tear of the posterior lens capsule, vitreous hemorrhage and hazy media. One important issue in the management of traumatic cataract is the perceived superiority of primary versus secondary cataract removal. When cataract surgery is performed simultaneously with the repair of open-globe injury or immediately after closed-globe injury it is called a primary procedure. In contrast secondary procedures are performed after an interval from the trauma. Primary procedures are recommended in patients with rupture of crystalline lens capsule to avoid lens particle glaucoma [7] and the prolapse of the vitreous body into the anterior segment. Secondary procedures are recommended in a quite eye when other traumatic injuries are addressed.

IOL power calculation could be performed using biometric parameters of the traumatized eye or the fellow eye. Some studies have reported the IOL power calculation by biometry of the fellow eye with acceptable refractive results and non-significant anisometropia [8-11].

In the presence of a posterior capsule tear with good capsular bag, the IOL can be placed in the bag [3]. When the remnants of the crystalline lens capsule can provide an effective support to avoid posterior dislocation of IOL, a 3-piece posterior chamber IOL could be implanted in ciliary sulcus [12]. In eyes with penetrating ocular trauma there may not be sufficient crystalline lens capsule to implant an IOL in the bag or ciliary sulcus. On the other hand blunt trauma may lead to severe zonulysis and a useless capsule. In these cases other options such as posterior and anterior iris claw IOL, anterior chamber IOL, scleral fixated posterior chamber IOL and iris fixated posterior chamber IOL could be considered.

Iris fixation and scleral fixation for posterior chamber IOLs have some potential complications. In scleral fixation intraocular hemorrhage due to uveal penetration by needle, refractive instability because of IOL tilt and endophthalmitis caused by suture tract from outside into the globe are potential risks [13-17]. Potential complications of iris fixation include iris chafing, pigment dispersion, chronic inflammation, Uveitis-Glaucoma-Hyphema syndrome, peripheral anterior synechia and glare as well as halo due to pupillary distortion [13, 17-19].

There is not sufficient data comparing visual outcomes and complications of scleral fixated and iris fixated posterior chamber IOLs in treatment of traumatic eyes. So the present study was conducted to compare visual outcome and complications of these two methods in patients with traumatic cataract who did not have proper capsular support for IOL implantation in the bag or sulcus.

Patients and Methods

The protocol of the present study was compliant with the provisions of the Declaration of Helsinki and was approved by the ethics committee of Army University of Medical Sciences, Tehran, Iran.

Thirteen eyes of 13 patients who underwent iris fixation and 12 eyes of 12 patients who underwent scleral fixation of posterior

chamber IOL between May 2015 and May 2016 were included. These patients were chosen among patients who presented to emergency department of Farabi Eye Hospital, Tehran, Iran, with traumatic cataract. Patients who were under 12 year old and cases with traumatic injury to posterior segment, such as vitreous hemorrhage and retinal detachment according to B-Scan ultrasonography, hypopyon in anterior chamber, laceration involving visual axis and laceration extending farther than 3 millimeters from limbus were excluded from the study.

Traumatic cataract surgery and IOL implantation was performed during the first week after primary repair in patients with penetrating injury and the first week after traumatic event in patients with blunt trauma.

Surgical techniques

All surgeries were performed by one experienced surgeon. Lens removal was done using the probe of vitrectomy machine with the cutting rate of 200 rpm and the aspiration of up to 150 mmHg through limbal incisions in 22 patients. In 3 patients with hard nucleus lens was removed using phacoemulsification.

Iris fixation of the posterior chamber IOL was performed using McCannel suture technique [20,21]. After preparing 2 limbal paracentesis 180 degrees apart from each other a 3-piece IOL was inserted into the anterior chamber. By capturing the optic by the miotic pupil, haptics were dislocated into the posterior chamber by a Sinskey hook. Then while a secondary instrument was used to tent the haptic against the iris a long straight needle with a 10-0 propylene suture was inserted from the limbus into anterior chamber and passed through the iris under the haptic and taken out by docking into a hollow 27-gauge needle from limbus. Then the needle was cut and the propylene suture taken out from the paracentesis was used to tie a knot. The knot was retrieved into the eye.

For fixation of IOL to sclera two triangular limbal base scleral flaps were prepared. A long straight needle with 10-0 propylene suture was passed 3 millimeters from limbus and under the flap into the globe and pulled out by a 27-gauge hollow needle from opposite side through pars plana. Then suture was dislodged from a limbal paracentesis and cut from middle. After breakthrough of a z-type cartridge each end of suture was tied to each haptic of the IOL. Then the IOL was injected into the posterior chamber and placed in an appropriate position. A propylene suture was used to tie a knot to adjacent tissue under the flap and the flap was deposited without suture.

Data collection and analysis

Patients who presented to emergency department with traumatic cataract were examined using slit lamp biomicroscope. Demographic data, visual acuity, type of trauma, findings of slit lamp examination, zone of injury and B-scan ultrasonography results were collected from patients entering the study. Patients were randomly assigned to iris fixation (Group I) or scleral fixation (Group II) groups. Follow up visits were performed one day, one week, four weeks, three months and six months after surgery. In each visit visual acuity, IOP, placement of IOL and anterior chamber reaction were studied. The refraction and BCVA measurements performed three months after surgery were recorded as final visual acuity. Visual acuity was measured using a Snellen chart and was converted to logarithm of the minimal angle of resolution for statistical analysis. Anterior chamber reaction was measured based on the standardization of uveitis nomenclature

(SUN) working group grading scheme for anterior chamber cells [22] and the presence of ≥2 cells in a high intensity 1x1 mm slit beam was considered significant one week after surgery.

Statistical analysis

Statistical analyses were performed using SPSS version 23 (IBM, Armonk, NY, USA). Data normality was assessed by Shapiro-Wilk test. Continuous variables were compared using independent t tests and Mann-Whitney U test, while categorical variables were compared using Pearson χ^2 tests and Fisher's exact test. P values less than 0.05 were considered statistically significant.

Results

Twenty five patients with traumatic cataract entered the present study. The average patient age at presentation was 29.12 ± 16.32 (Range 12-80 years). There was no significant difference between the two groups of patients regarding their mean age (P = 0.352). In the iris fixation group (Group I) 12 patients were male and one patient was female. Ten male and 2 female patients were in the scleral fixation group (Group II). Ten patients in each group had open-globe trauma while three patients in group I and two patients in group II had closed-globe injures (Table 1). Among 20 patients who had open-globe injury penetrating wound was in zone I in 16 patients and in zone II in 4 patients. Zone II was the zone of injury in 5 patients that had closed-globe injury. Visual acuity in group I at presentation was light perception (LP) in 3 patients, hand motion (HM) perception in 4 patients and counting fingers (CF) up to 1 meter in 6 patients. In group II visual acuity was LP in 3 patients, HM in 7 patients and CF up to 1 meter in 2 patients.

In follow up visit 1 week after IOL fixation three patients in each group had significant anterior chamber inflammation. Three patients in group II had elevated IOP during the first week after surgery but none of patients in group I developed this complication, however, there was not a statistically significant difference between the two groups (P = 0.96). Two patients in group I developed dislocated IOL during follow up visits while this complication did not happen in group II (P = 0.480). Other complications such as wound dehiscence and iridocorneal adhesion were observed in one patient in group I and one patient in group II respectively.

Visual acuity improved after surgery in both groups. The mean BCVA three months after surgery in group I was 0.466 ± 0.251 LogMAR in patients with visual acuity of LP at presentation, 0.425 ± 0.403 LogMAR

Table 1: Demographic data and ocular characteristics of patients entering the study

Variable	Iris fixation group	Scleral fixation group	P value
Eyes/patients	13	12	
Age at presentation (mean ± SD, y)	26.1 ± 17.6	32.3 ± 14.7	0.35[a]
Gender (M/F)	12/1	10/2	0.59[b]
Laterality (OD/OS)	7/6	9/3	0.41[b]
Type of injury (Open-globe/ Closed-globe)	10/3	10/2	1.00[b]

a: Independent-samples t test; b: Fisher's exact test

in patients with visual acuity of HM and 0.483 ± 0.354 LogMAR in patients with visual acuity of CF up to 1 meter at presentation respectively. In group II the mean BCVA three months after surgery was 0.466 ± 0.472 LogMAR, 0.428 ± 0.298 LogMAR and 0.100 ± 0.00 LogMAR in patients with visual acuity of LP, HM and CF up to 1 meter at presentation, respectively (Table 2). The mean BCVA three months after surgery was 0.461 ± 0.322 LogMAR in group I and 0.383 ± 0.327 in group II indicating no statistically significant difference (P = 0.55).

The relationship between BCVA three months after surgery and the type of trauma (open-globe versus closed-globe), regardless of the type of fixation, was assessed. BCVA was 0.40 ± 0.32 LogMAR in patients with open-globe and 0.50 ± 0.32 LogMAR in patients with closed-globe injury indicating no statistically significant difference between these two groups (P = 0.57).

The mean BCVA was 0.43 ± 0.34 LogMAR in patients with penetrating injury in zone I and 0.30 ± 0.21 LogMAR in patients with open-globe injury in zone II indicating no statistically significant relation between BCVA and the zone of injury (P = 0.37).

Discussion

The present study compared two surgical methods for fixation of IOL among patients suffering from traumatic cataract and insufficient capsular support. Both surgical techniques improved visual acuity and were stable for at least 6 months. Postoperative complications were similar between two methods. Zone of injury was not a determinant factor for final visual acuity in our study.

A study by Kuhn et al., [23] found that any injury to retinal tissue in patients with traumatic cataract will result in reduced final visual acuity. We omitted patients with traumatic injury to the retina, optic nerve and ocular adnexa in the present study to diminish confounding factors. In the present study the age and sex of patients did not have any effect on final visual acuity similar to a previous study [24].

One challenge in managing traumatic cataract is the perceived superiority of primary versus secondary procedures. Memon et al., [25] have suggested that if there is cortical lens material or vitreous in the anterior chamber or the crystalline lens is severely subluxated it is better to remove cataract as a primary procedure. In another study by Agarwal et al., [26] the authors suggested early removal of traumatic cataract in patients with severe corneal laceration to prevent corneal decompensation which may happen in secondary procedures. In a study by Chuang et al., [27] the authors concluded that prompt surgical intervention for traumatic cataract and subsequent IOL implantation will improve visual acuity of the patients with penetrating ocular trauma, but their study was not a case control study. A study performed by Rumelt et al., [7] on 69 eyes with traumatic cataract including both open-globe and

Table 2: Visual acuity in two groups of patients three months post operation

Visual acuity	Iris fixation (Group I)			Scleral Fixation (Group II)		
	N	Mean	Std. Deviation	N	Mean	Standard Deviation
LP	3	0.466	0.251	3	0.466	0.472
HM	4	0.425	0.403	7	0.428	0.298
CF at up to 1 m	6	0.483	0.354	2	0.100	0.000
Total	13	0.461	0.322	12	0.383	0.327

closed-globe injuries suggested that the timing of surgery (as immediate surgery or later as a second surgery) and the timing of intraocular lens implantation (during the extraction of the cataract or later in a secondary procedure) is not associated with BCVA of 20/40 or better.

In our study the maximum interval between repair of traumatic wound and cataract surgery was 1 week and the fixation of the IOL was done at the time of cataract removal.

In a study performed by Kim et al., [13] to compare the outcomes of iris fixation and scleral fixation for dislocated IOL, BCVA improved significantly one week after surgery in scleral fixation group and one month after surgery in both groups [13]. Post operative inflammation was higher in the iris fixation group and the difference in BCVA between the two groups was probably because of this higher post operative inflammation in the iris fixation group [13]. Recurrence was similar between the two groups, but it happened earlier in the iris fixation group because of cheese wiring of the iris by sutures and solid nature of the sclera [13]. Two of our patients in group I endured IOL dislocation, but the difference between the two groups was not statistically significant.

For fixation of the IOL to the iris, haptics are sutured to iris and iris chafing and pigment release might happen because of pupillary constriction and dilation. By passing the needle through iris, the vascular network may be injured and WBCs and RBCs enter the anterior chamber. Based on this hypothesis post operative inflammation and IOP rise should be more prevalent in fixation of the IOL to the iris. In the present study we did not observe statistically significant difference between groups regarding IOP elevation.

In the present study BCVA three months after surgery was similar in patients with open-globe and closed-globe injury. In a study by Woo and Sundar [28] patients with open-globe injury had lower visual acuity than patients with closed-globe injury at presentation and after treatment. Also Mallika et al., [29] reported lower final visual acuity in patients with open-globe injuries. In another study in Malaysia 179 traumatized eyes were evaluated. Patients with open-globe injury had lower visual acuity at admission and the number of patients with worsening or no improvement in visual acuity was higher in this group compared to patients with close-globe traumas [30]. The lack of significant difference between the two groups in our study three months postoperatively was probably because of the low sample size in the present study.

We also analyzed the relation between final visual acuity and zone of injury in patients with traumatic cataract and open-globe injury. In a study performed between 2001 and 2011 on 265 traumatic eyes in Iraq patients with open-globe injury in zone III required more surgical intervention in comparison to patients with open-globe injury in zone I and final visual acuity was lower among them, while patients with open wound in zone II had a surgical rate between the two other zones [31]. In another study on 172 injured eyes it was observed that visual acuity at presentation is the most important prognostic factor for visual improvement and with extension of the wound to posterior the prognosis will worsen [32]. In the present study patients with penetrating wound in zone III were excluded from study because of probable injury to the retina and optic nerve. The final visual acuity was similar when comparing patients with open-globe injury in zone I and zone II.

Our sample size was relatively small because of strict inclusion and exclusion criteria. Also we only followed the patients for 6 months. We recommend further investigations to compare

these two IOL fixation methods in with larger sample sizes and longer follow up periods.

Conclusion

We did not observe any significant difference in outcome of iris and scleral fixation of IOL in traumatic eye injuries with no effective capsular support. We recommend further investigations with larger sample sizes and longer follow up periods to better compare these two methods.

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Footnotes and Financial Disclosures

Conflict of interest:

The authors have no conflict of interest with the subject matter of the present study.