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Original Research Article

Comparative Analysis of Iris Claw IOL and Scleral Fixation IOL: Visual Outcomes and Complications

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Abstract:

Introduction: This prospective study aimed to conduct a comparative analysis of visual outcomes and complications associated with two intraocular lens (IOL) fixation techniques: iris claw IOL and scleral fixation IOL. The primary objective was to evaluate changes in best-corrected visual acuity (BCVA), intraocular pressure (IOP), and the occurrence of early and late post-operative complications in patients undergoing these procedures.

Material and Methods: A total of 60 eyes from 60 patients were included in the study, with 30 eyes receiving iris claw lenses (Group A) and 30 undergoing scleral fixation IOL (Group B). Comprehensive pre-operative and post-operative assessments, including BCVA, slit lamp examinations, and IOP measurements, were conducted on postoperative days 1, 4th week, and 12th week.

Results: In our study involving 60 eyes, iris claw lenses showed superior visual outcomes compared to scleral fixation IOL. The iris claw group exhibited better uncorrected and corrected visual acuity. Notably, scleral fixation IOL led to a significant increase in intraocular pressure at various postoperative intervals. Early complications such as anterior chamber reactions and pupil distortions were more frequent in the iris claw group. Late complications, including IOL decentration and tilt, cystoid macular edema, and retinal detachments, were more prevalent in the scleral fixation group.

Conclusion: The study reveals a trade-off between iris claw IOL and scleral fixation IOL. Iris claw IOL offers improved visual acuity but comes with a higher risk of early complications. On the other hand, scleral fixation IOL is linked to elevated IOP and a greater likelihood of late complications.

Keywords: Iris Claw IOL, Scleral Fixation IOL, Visual Outcomes, Post-operative Complications

Introduction

Cataract surgery, the gold standard for addressing visual impairment, involves removing the opacified crystalline lens and implanting an intraocular lens (IOL) in the capsular bag. [1] The choice of IOL implantation technique becomes crucial in challenges like compromised anterior capsular support or a ruptured posterior capsule. [2] For good anterior capsular support, a three-piece ciliary sulcus IOL is conventionally placed. However, in cases of aphakia with inadequate capsular support, secondary implantation is necessary, with options like scleral-fixated posterior chamber IOLs (SFIOLs), angle-supported anterior chamber IOLs (AACIOLs), or iris-fixated anterior chamber IOLs (IACIOLs). [3,4]

In ophthalmology, choosing between Iris Claw IOL and Scleral Fixation IOL requires a nuanced evaluation of anatomy and surgical goals. The Iris Claw IOL, or Artisan lens, uniquely clings to the iris, providing stability without relying on capsular support. [5] This is advantageous when traditional support is compromised due to trauma, weak zonules, or congenital anomalies. [6,7] In contrast, Scleral Fixation IOL secures the lens to the sclera using sutures, offering flexibility in addressing clinical scenarios, including complex cataracts or intraoperative complications, without the need for intact zonules or a stable iris. [8,9]

The theoretical foundation of this study is grounded in the historical evolution of IOL implantation techniques, from Parry's suture-fixated IOL to Worst's iris pupil-fixated lenses. [10,11] Recognizing these milestones, the study aims to compare visual outcomes and complications of contemporary approaches: scleral fixation IOL and Iris Claw IOL for aphakic eyes lacking sufficient capsular support. Objectives include evaluating visual rehabilitation efficacy and delineating complications, guiding surgeons in selecting the most suitable technique for optimal outcomes in challenging cases.

Material and Methods

A prospective study was conducted at tertiary care center with a focus on comparing the outcomes of Iris Claw IOL and Scleral Fixation IOL procedures. Thirty patients who underwent Iris Claw IOL and another thirty who underwent Scleral Fixation IOL were included based on defined inclusion and exclusion criteria. The patients were categorized into two groups: the Iris-claw group (Group A) and the Scleral-fixated IOL group (Group B). Inclusion criteria encompassed cases with intraoperative posterior capsule tear, aphakia following cataract extraction, uncomplicated cataracts, and best-corrected aphakic visual acuity ≥ 6/18. Exclusion criteria included conditions like aphakia following trauma, IOL drop, best-corrected aphakic visual acuity ≤ 6/24, pre-existing glaucoma, pseudo exfoliation syndrome, corneal opacity in the visual axis, penetrating keratoplasty, pars plana vitrectomy for posterior cataract nucleus, rubeosis iriditis, aniridia, proliferative diabetic retinopathy, and any posterior segment pathology or anomaly.

The Iris Claw IOL technique involved using the Excel iris claw lens with an optic size of 5.5 mm and total length of 9.00 mm for retro pupillary fixation. The IOL power calculation utilized the SRK T formula with an A constant of 117.2, choosing lens power for emmetropia. After making a superior scleral incision and two side port incisions, anterior vitrectomy and peripheral iridectomy were performed as needed. The claw lens was introduced into the anterior chamber, stabilized with Shepard's forceps, and enclavation was achieved using a reverse sinskey hook. The end point was the presence of a dimple at the enclavation site, ensuring proper fixation and preventing spontaneous de-enclavation. The incision was secured with interrupted 10-0 nylon suture, followed by closure of the conjunctiva with 8-0 vicryl suture. The surgical procedure included irrigation and aspiration, stromal hydration, and a subconjunctival injection of (0.5 ml gentamycin + 0.5 ml dexamethasone) at the end of the surgery.

Patients were randomly allocated iris claw IOL or scleral fixation IOL. The study design involves assessing pre-operative and post-operative parameters such as best-corrected visual acuity, slit lamp examination, and intraocular pressure at specific intervals (Postoperative day 1, 4th week, and 12th week) for both Iris Claw IOL and Scleral Fixation IOL groups.

Data analysis was conducted using SPSS version 25.1. Descriptive statistics summarized continuous variables with mean and standard deviation, while categorical variables were presented as frequencies and percentages. Group differences between Iris Claw IOL and Scleral Fixation IOL were assessed using independent t-tests or Mann-Whitney U tests for continuous variables and Chi-square or Fisher's exact tests for categorical variables. A significance level of 0.05 was applied.

Results

In this study, a total of 60 eyes from 60 patients were enrolled, with 30 eyes undergoing Iris Claw lens implantation (Group A) and another 30 eyes receiving scleral fixation IOL (Group B). The distribution of gender revealed that out of the 60 patients, 40 were male and 20 were female. Regarding age demographics, all patients fell within the 21-80 years age range, with the majority concentrated between 51 and 70 years old.

Preoperatively, visual acuity in Group A (Iris Claw lens) showed 60% achieving 6/6-6/9 and 40% in the 6/12-6/18 range. In Group B (scleral fixation IOL), 57% achieved 6/6-6/9, and 43% were in the 6/12-6/18 range. There was no statistically significant difference between the two groups ($p > 0.05$).

The postoperative distance visual acuity correlation between Group A (Iris Claw lens) and Group B (scleral fixation IOL) is summarized. In the 6/6-6/12 acuity range, 30% of Group A and 7% of Group B achieved it, with a significant p-value of 0.014. For 6/18-6/36 acuity, 30% in Group A and 13% in Group B, while in the 6/60-4/60 range, 17% in Group A and 27% in Group B. In the 3/60-HM+PL+PR+4 category, 23% belonged to Group A, and 53% to Group B. Notably, during the 1st postoperative week, visual acuity dropped below the preoperative level in both groups, subsequently improving after the 4th postoperative week. (Table 1)

Table 1: Co-relation between Post-operative Day 1 distance visual acuity

Visual acuity	Group A (n=30)	Group B (n=30)	P value
6/6-6/12	9(30%)	2(7%)	0.014
6/18-6/36	9(30%)	4(13%)	
6/60-4/60	5(17%)	8(27%)	
3/60-HM+PL+PR+4	7(23%)	16(53%)	

Postoperative visual acuity at the 4th week reveals significant differences between Group A (Iris Claw lens) and Group B (scleral fixation IOL). In the 6/6-6/12 range, 67% of Group A and 33% of Group B achieved it, with a p-value of 0.019. Notable distinctions are observed in visual outcomes, particularly in the 6/6-6/12 category, emphasizing the effectiveness of the Iris Claw lens in achieving better visual acuity at the 4th postoperative week. (Table 2)

Table 2: Co-relation between Post-operative visual acuity at 4th week

Visual acuity	Group A (n=30)	Group B (n=30)	P Value
6/6-6/12	20(67%)	10(33%)	0.019
6/18-6/36	5(17%)	4(13%)	
6/60-4/60	4(13%)	9(30%)	
3/60-HM+PL+PR+4	1(3%)	7(24%)	

The table 3 compares postoperative visual acuity between Group A (Iris Claw lens) and Group B (scleral fixation IOL). Group A outperformed Group B in the 6/6-6/12 acuity range (64% vs. 37%), and similar trends were noted in the 6/18-6/36 and 6/60-4/60 categories, with Group A showing lower percentages. Additionally, Group B had a higher percentage in the 3/60-HM+PL+PR+4 category. Notably, a significant difference (p = 0.022) in corrected distance visual acuity at the 12th week favored Group A, indicating superior visual outcomes compared to Group B.

Table 3: Co-relation between Post-operative 12th week visual acuity

Visual acuity	Group A (n=30)	Group B (n=30)	P Value
6/6-6/12	19(64%)	11(37%)	p = 0.022
6/18-6/36	6(20%)	3(10%)	
6/60-4/60	4(13%)	9(30%)	
3/60-HM+PL+PR+4	1(3%)	7(23%)	

The intraocular pressure (IOP) comparison between Group A (Iris Claw lens) and Group B (scleral fixation IOL) revealed significant differences. Preoperatively, Group A had a mean IOP of 16.56±3.77, and Group B had 15±3.88 (p = 0.006). Postoperatively, significant differences persisted on the 1st postoperative day (p = 0.0001), 4th week (p = 0.0026), and 12th week (p = 0.02). (Table 4)

Table 4: Co-relation between Pre-operative &Post-operative IOP

Mean IOP	Group A (n=30)	Group B (n=30)	t-test	P value
Pre-operative	16.56±3.77	15±3.88	2.8	0.006
Post-Operative Day 1	15.30±6.37	19.2±4.83	5.44	0.0001
Post-Operative Week 4	15.9±6.16	18.93+-5.81	3.1	0.0026
Post-Operative Week 12	16.76+-4.04	18.03+-4.67	2.3	0.02

Early postoperative complications were assessed in both groups up to 12 weeks. The most prevalent complications included anterior chamber (AC) reaction in 51% of patients, vitreous strand in AC in 36%, and pupil distortion in 23%. Less frequent complications included hypopyon in 16%, increased intraocular pressure (IOP) in 13%, hyphema in 6%, and vitreous hemorrhage in 6%. Figure 1 summarizes the late post operative complications after 12th week of post operative period.

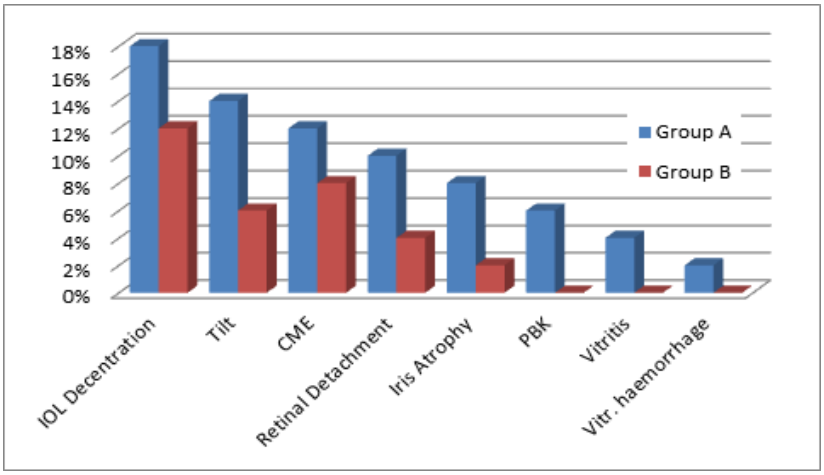

Figure 1: Late postoperative complications

In our study, group A (Iris Claw lens) had higher re-surgery rates than Group B (Scleral Fixation IOL): 7% vs. 3% for IOL explantation, 6% vs. 2% for trabeculectomy, 4% vs. 1% for tunnel resuturing, and 3% vs. 1% for retinal detachment surgery. (Figure 2)

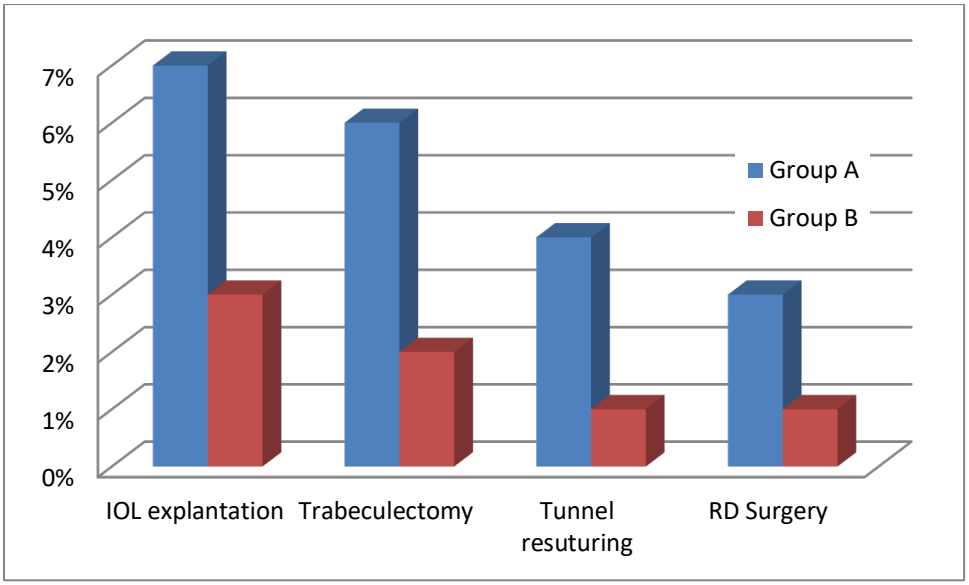

Figure 2: Re-surgery in both groups

Discussion

In this study, involving a cohort of 60 eyes from 60 patients, the comparative analysis focused on the outcomes of retropupillary Iris Claw lens implantation in Group A and scleral fixation IOL in Group B. The choice between these two techniques is crucial in addressing cases with compromised capsular support or other challenging scenarios. The allocation of patients into distinct groups allowed for a systematic evaluation of visual outcomes, complications, and re-surgeries associated with each approach.

The preoperative phase revealed comparable baseline visual acuity in both groups, emphasizing the need for subsequent assessments. In the 6/6-6/9 and 6/12-6/18 ranges, no statistically significant differences were noted, establishing a balanced starting point. Postoperatively, Group A (Iris Claw) showed higher rates of 6/6-6/12 visual acuity, suggesting potential advantages. However, this benefit was counterbalanced by increased complications and re-surgeries, emphasizing the importance of carefully weighing the risk-benefit profiles of each technique. [12] Our study findings demonstrated comparable visual outcomes between the two groups, aligning with the observations of various related studies. Madhivanan et al.'s [13] retrospective analysis revealed a significant advantage in best-corrected distance visual acuity (BCDVA) for Scleral Fixation IOL at 1 month postoperative. However, this advantage diminished, and both groups exhibited comparable BCDVA at the 1-year mark. Similarly, Kelkar et al.'s [14] study showcased significant improvement in uncorrected distance visual acuity (UCDVA) at 6 weeks for both groups, with comparable UCDVA between Iris Claw and Scleral Fixation IOL at 1 year. These trends emphasize the dynamic nature of visual outcomes and the need for long-term assessments to gauge the effectiveness of each technique. [14]

A study by Navya et al.'s [15] study, aligning with our findings, highlights the comparable visual outcomes of iris claw IOL and SFIOL while underscoring the efficiency of one technique over the other in terms of surgical time and complications. Daigavan et al.'s [16] study supports the notion that both techniques are viable for secondary IOL implantation with comparable visual outcomes, emphasizing the complexities associated with each method, such as retinal detachment in the SFIOL group and immediate postoperative iritis and pupil ovalization in the iris claw group. Gaafar et al.'s [17] study and Bodin et al.'s [18] comparative study, incorporating different IOL types, affirm the safety and effectiveness of iris claw ACIOL and scleral-fixated PCIOL in managing ectopia lentis. Additionally, Bodin et al. [18] introduces the Carlevale® intraocular lens as potentially offering better refractive accuracy and less induced astigmatism compared to Artisan® iris-claw lenses.

Another study by Kim et al.'s [19] study encompassed a comparative analysis of conventional scleral fixation (C-SF), retropupillary iris-claw intraocular lens (RP-IOL) implantation, and intrascleral fixation (ISF). Their findings underscored the significance of postoperative visual acuity improvements, with noteworthy complications unique to the RP-IOL group, such as IOL dislocation. Drawing parallels with our study, both investigations emphasize the critical balance between enhanced visual outcomes and potential complications inherent in these surgical procedures.

Our examination of Intraocular Pressure (IOP) included pre-operative and post-operative assessments. A significant finding in our study was the increase in IOP observed on the 1st postoperative

day, particularly in the Iris Claw group. This trend was also noted in Kelkar et al.'s [14] study, where a transient elevation of intraocular pressure was slightly more prevalent in eyes with Scleral Fixation IOL. Analyzing IOP fluctuations and differences between the groups is crucial in understanding the immediate postoperative period's dynamics. As IOP can influence visual outcomes and potential complications, this aspect is pivotal for comprehensive postoperative care.

Analyzing complications is crucial in evaluating the safety and feasibility of different IOL implantation techniques. Complications in Group A included issues such as IOL decentration, tilt, and cystoid macular edema, whereas Group B experienced lower rates of these complications. Interestingly, the rates of re-surgeries, including IOL explantation, trabeculectomy, and tunnel resuturing, were higher in Group A, reflecting the need for additional interventions to address complications. The observed complications and re-surgeries emphasize the importance of careful patient selection and surgical technique in determining the optimal approach for each case. The higher rates of complications in Group A, despite potentially superior visual outcomes, raise questions about the long-term stability and sustainability of these outcomes. These rates are consistent with the varied complications reported in studies by Madhivanan et al. [13], Kelkar et al. [14], Navya et al. [15], Daigavan et al. [16], and Gaafar et al. [17] The diversity in complications underscores the importance of tailoring surgical decisions based on individual patient characteristics and surgeon expertise.

Our study has certain limitations. The degree of postoperative tilt of IOLs in each group was not measured, and the correlation between tilt and astigmatism was not analyzed. This limitation underscores the need for a larger dataset to facilitate a more comprehensive analysis and enhance the robustness of our findings.

Conclusion

Our study reveals that both Iris Claw IOL and Scleral Fixation IOL are effective options for addressing aphakia, providing excellent visual outcomes up to the 12th postoperative week. While Iris Claw IOL demonstrates an advantage in the 6/6-6/12 visual acuity range, it is associated with higher complication rates and re-surgeries. On the other hand, Scleral Fixation IOL offers comparable visual rehabilitation with lower complication rates, emphasizing its viability in challenging cases. The choice between these techniques should be guided by a careful consideration of the specific anatomical challenges and the desired risk-benefit profile for optimal outcomes in aphakic eyes without sufficient capsular support.

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