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Visual Outcomes and Postoperative Complications of ACIOL vs. SFIOL: A Prospective Comparative Study

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ABSTRACT

Anterior chamber intraocular lens and scleral fixated intraocular lens are key options for patients without capsular support, necessitating a comparison of their visual outcomes and complications. **Objectives:** To analyze and contrast the postoperative visual results and complications amongst patients who underwent cataract surgery or secondary lens implantation and received either an anterior chamber intraocular lens or a scleral fixated intraocular lens. **Methods:** The total number of participants was n=120: Group I involved 60 eyes that received an anterior chamber intraocular lens while Group II involved 60 eyes that were given a scleral fixated intraocular lens. The primary outcomes measured were best-corrected visual acuity before the procedure and then at 1-, 3-, and 6-months post-op, whereas secondary outcomes included complications such as inflammation, elevated intraocular pressure, dislocation of the artificial intraocular lens, as well as other postoperative adverse events. SPSS 23 was used. **Results:** At the 6-month mark, both groups demonstrated significant improvement in best-corrected visual acuity compared to pre-op levels, with no noteworthy difference in final visual acuity between those who received an anterior chamber intraocular lens versus a scleral fixated intraocular lens. The mean best-corrected visual acuity for Group I was 6/9 whereas Group II presented with a mean best-corrected visual acuity of 6/12 ($p>0.05$). No significant discrepancies in complication rates were observed between the two procedures. **Conclusions:** It was concluded that anterior chamber intraocular lens implantation and scleral fixated intraocular lens implantation can yield positive visual outcomes for patients undergoing cataract surgery or secondary lens implantation.

INTRODUCTION

One of the most commonly performed ophthalmic procedures worldwide is cataract surgery in which patients who have lens opacities or lens disorders can attain clear vision again. For many patients, with complicated cases, this will require replacing the natural lens with an artificial intraocular lens (IOL) to restore the clarity of vision [1,]. Specifically, common solutions for aphakia, subluxated lenses, as well as complexities due to intraoperative and post-operative cataract challenges include the use of anterior chamber intraocular lenses (ACIOLs) and porous and suture-less scleral fixated intraocular lenses (SFIOLs) [2]. ACIOLs (anterior chamber intraocular lenses) are placed in the anterior chamber of the eye and are commonly preferred when there is no supporting area for these lenses in the posterior capsule [3]. They are used in primary and secondary implants, especially in posterior capsular rupture and insufficient capsular support. However, associated complications have been reported, including loss of corneal endothelial cells, raised intraocular pressure, and greater risk of ocular inflammation [4]. SFIOLs are inserted when both anterior segment and posterior segment support are lacking. These lenses are anchored to the sclera with sutures for a durable, long-lasting placement. Although good anatomical positioning and lower risks of anterior segment complications are advantages of SFIOLs, they still need

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advanced surgical skills which carry risks like suture-related problems, scleral thinning, scleral perforation, and retinal detachment [5, 6]. The two types of IOLs each have their advantages and disadvantages, and we must compare both the visual results and any subsequent complications in surgery that each monitor might create so that the two can be clinically compared with one another for the more challenging types of cataracts [7, 8]. The effectiveness of ACIOL and SFIOL by determining best-corrected visual acuity (BCVA) improvement and incidence of complications [lens dislocation, inflammation in anterior segment and intraocular pressure (IOP) changes] [9].

This study aims to analyze and contrast the postoperative visual results and complications amongst patients who underwent cataract surgery or secondary lens implantation and received either an Anterior Chamber Intraocular Lens (ACIOL) or a Scleral Fixated Intraocular Lens(SFIOL).

METHODS

This retrospective cohort study was conducted from April 2022 to September 2022 at the Department of Ophthalmology at Arif Memorial Teaching Hospital/Rashid Latif Medical College, Lahore. Inclusion criteria: included adults aged 41 to 74 who had inadequate posterior capsule backing requiring an alternative lens placement following extraction. Exclusion criteria: comprised of active ocular disease, uncontrolled glaucoma, or systemic conditions that may interfere with surgery or recovery. The formula for sample size calculation was $n=2(Z\alpha/2+Z\beta)2\cdot\sigma2/\Delta2$. The required sample size was approximately 120 participants to estimate the power 80%, confidence level 95%, standard deviation (σ\sigma σ) 0.3 and clinically significant difference (Δ\Delta Δ) 0.2 [10]. Patient data were gathered from medical records, covering demographic information, preoperative and postoperative visual acuity (VA), refractive error, and complication rates. A thorough eye exam was conducted before and after surgery, with patients monitored for at least six months. For ACIOL implantation, the lens was positioned in the anterior chamber, either in the angle or using a secured system, with the choice of a single-piece or multi-component design left to the surgeon's preference. In SFIOL implantation, the lens was affixed to the sclera employing 10-0 nylon or polypropylene sutures, with or without the utilization of a glued arrangement. The surgeries addressed conditions such as aphakia, subluxated lenses, and posterior capsular tears. Patients with exclusions like glaucoma, iritis, amblyopia, and poor vision unrelated to cataracts were omitted. The sampling technique employed in this study was consecutive sampling, where all eligible patients presenting during the study period who met the inclusion criteria were enrolled. Preoperative and postoperative best-corrected visual acuity (BCVA) were documented. Follow-ups at one, three, and six months recorded BCVA and any complications included ACIOL group, complications included corneal decompensation, glaucoma, and cystoid macular oedema. In the SFIOL group, retinal detachment, suture-related issues, and hypotony were observed. The data were analyzed using SPSS version 23.0 to gain insights. Visual outcomes and intraocular pressure were recorded before surgery and at various intervals afterwards for patients receiving either ACIOL or SFIOL implants. Paired t-tests internally compared each group's results over time. Independent t-tests distinguished the groups' performances at each checkpoint. Postoperative complications were also tracked using Chi-square tests to categorize outcomes. Informed consent was obtained from all participants, and approval from the Institutional Review Board (IRB) was secured for the study. This study was approved by the institutional review board (IRB/2023/205) of Rashid Latif Medical College, Lahore.

RESULTS

The preoperative characteristics of the ACIOL and SFIOL groups were comparable, with no significant differences in age, gender, or indications for implantation. Both groups had a mean age of 65 years, and a balanced gender distribution (50% male and 50% female). Statistical analysis revealed no significant differences between the two groups in terms of these factors, indicating that the groups were similar at baseline (Table 1).

Table 1: : Preoperative Characteristics of the Study Population

Preoperative Characteristics	ACIOL Group (n=60)	SFIOL Group (n=60)	Total (n=120)	Statistical Analysis
Mean Age (Years)	65 ± 10	65 ± 12	65 ± 11	>0.005
Gender Distribution				
Male (%)	30 (50%)	30 (50%)	60 (50%)	Chi-square =0.0, p=1.0
Female (%)	30 (50%)	30 (50%)	60 (50%)	

In both arms, ACIOL and SFIOL caused significant enhancement in best-corrected visual acuity (BCVA) at all time intervals. The preoperative baseline visual acuity was 6/60 in most patients in both groups. At 1-month postoperatively both groups showed early gains with more patients achieving 6/6-6/9 vision. At 3 months, there was an additional rise in the proportion of patients in the 6/6-6/9 category for both groups and by 6 months, the vast majority of patients from both groups had achieved 6/6-6/9 vision, while only a small subset of patients from either group remained in the 6/60 and worse category. Both types of IOLs provided clinically significant visual benefits ($p<0.001$)(Table 2).

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Table 2: Distribution of BCVA Categories Preoperative and Postoperative at 1 Month, 3 Months, and 6 Months

BCVA Category	Preoperative (ACIOL Group, n=60)	1 Month Postoperative (ACIOL Group, n=60)	3 Months Postoperative (ACIOL Group, n=60)	6 Months Postoperative (ACIOL Group, n=60)	Preoperative (SFIOL Group, n=60)	1 Month Postoperative (SFIOL Group, n=60)	3 Months Postoperative (SFIOL Group, n=60)	6 Months Postoperative (SFIOL Group, n=60)	Chi-Square Test	p-value
6/6 - 6/9	5 (8.3%)	15 (25%)	30 (50%)	45 (75%)	4 (6.7%)	12 (20%)	32 (53.3%)	43 (71.7%)	62.5	p<0.001
6/12 - 6/18	15 (25%)	25 (41.7%)	20 (33.3%)	10 (16.7%)	10 (16.7%)	20 (33.3%)	18 (30%)	12 (20%)	15.2	p<0.001
6/60 and worse	40 (66.7%)	20 (33.3%)	10 (16.7%)	5 (8.3%)	46 (76.7%)	28 (46.7%)	10 (16.7%)	5 (8.3%)	122.8	p<0.001

There were no statistically significant differences in the analysis of postoperative complications between ACIOL and SFIOL groups. Complication rates, such as postoperative inflammation, endothelial cell loss, glaucoma, hyphemia, IOL displacement, and vitreous hemorrhage were similar between both groups. In particular, although the rate of postoperative inflammation was 8.3% for the ACIOL group and 13.3% for the SFIOL group, the difference was not significant (p=0.092). Other adverse events including loss of endothelial cells, glaucoma, hyphema, and IOL dislocation occurred at a similar frequency between the two groups (p>0.05, symbolically indicating that there was not a significant difference). Vitreous hemorrhage was uncommon with only one case occurring in the SFIOL group (statistically insignificant, p=0.420). Conclusions POSTCOMP, the study suggests that ACIOL and SFIOL implants are equally safe about postoperative complications (Table 3).

Table 3: Postoperative Complications in ACIOL and SFIOL Groups

Complication	ACIOL Group (n=60)	SFIOL Group (n=60)	Chi-Square Test	p-value
Postoperative Inflammation	5 (8.3%)	8 (13.3%)	2.85	p=0.092
Endothelial Cell Loss	10 (16.7%)	12 (20%)	0.45	p=0.503
Glaucoma	3 (5%)	4 (6.7%)	0.18	p=0.670
Hyphema	2 (3.3%)	3 (5%)	0.13	p=0.711
IOL Displacement	1 (1.7%)	2 (3.3%)	0.28	p=0.595
Vitreous Hemorrhage	0 (0%)	1 (1.7%)	0.65	p=0.420

When comparing the IOP between the ACIOL and SFIOL groups, no significant differences were observed at the preop level or 1, 3, and 6 months postoperatively. Table II shows that both groups had similar IOP throughout the study, with p values being larger than 0.05 at all-time points, which indicates that IOP was not significantly different between the two groups. That means ACIOL and SFIOL have a more or less similar effect on IOP after a period (Table 4).

Table 4: Comparison of Intraocular Pressure (IOP) Preoperative and Postoperative (1 Month, 3 Months, and 6 Months) in ACIOL and SFIOL Groups

Time Point	ACIOL Group (n=60)	SFIOL Group (n=60)	Chi-Square Test	p-value
Preoperative IOP (mmHg)	14.5 ± 2.3	14.2 ± 2.1	0.46	p=0.647
1 Month Postoperative IOP	15.2 ± 2.6	15.8 ± 2.4	1.23	p=0.219
3 Months Postoperative IOP	16.1 ± 2.7	16.4 ± 2.5	0.43	p=0.669
6 Months Postoperative IOP	16.3 ± 2.5	16.7 ± 2.6	0.53	p=0.597

DISCUSSION

It was done to compare the visual outcome and complications of implantation of the Anterior Chamber Intraocular Lens (ACIOL) and Scleral Fixated Intraocular Lens (SFIOL). Significantly improved best corrected visual acuity (BCVA) for both groups was evident during a follow-up of 6 months with no statistically significant differences between the groups. Both ACIOL and SFIOL implants were equally safe in regards to postoperative complications and intraocular pressure (IOP) stable over time in both groups [11, 12]. Also, there is a great improvement in the visual equity of both ACIOL and SFIOL groups in our study and in a time comparison at the 6th month postoperatively; 71% of the patients of the ACIOL group and 67% of the SFIOL group could see 6/6-6/9 vision. This result is in concordance with the previous studies. This is consistent with other studies, which also found significant visual improvement post-ACIOL and SFIOL implantation [13]. On the contrary, there are several studies noted the superiority of incomplete exposure of SFIOLs in providing comparable initial BCVA due to reduced problems with decentration and glare or corneal endothelial cell loss resulting from SFIOLs by stable slit-lamp patterns over time, which our study did not demonstrate [14]. The current study aligned with previous studies that ACIOLs have more immediate visual improvement after surgery, however, they can have higher rates of post-operative complications such as corneal endothelial cell loss and post-operative IOP spikes although these have not been statistically significant in our results [15]. The lack of clinically relevant differences in visual function between the two lens types suggests that lens selection may be better guided by the relevant clinical situation, and any anatomical considerations, than expected differences in visual outcomes [16, 17]. As for complications, there was no difference in postoperative inflammation, endothelial cell loss, glaucoma, hyphema, IOL dislocation, and vitreous hemorrhage between ACIOL and SFIOL. Complications seen were consistent with other studies. For instance, this group found a higher risk of endothelial cell loss for ACIOLs compared to other IOLs given the closeness of ACIOLs to the cornea [19]. Patients

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with ACIOLs were also found to have a higher risk of glaucoma, especially in those with pre-existing ocular conditions. Nevertheless, we found no significant difference in the incidence of these complications, possibly due to the selective patient population and the management protocols [20]. Liang et al., the relatively better stability of the IOLs in the long term due to SFIOLs, although they may be complicated by scleral perforation or IOL dislocation as a consequence of insufficiently secured scleral fixation. We found only 1 IOL dislocation in the ACIOL group and 2 in the SFIOL group, and this difference was not statistically significant. These conclusions are consistent with earlier research showing that SFIOLs are safer about corneal complications, while, on the other hand, SFIOLs may cause surgical technique issues and posterior segment complications [21]. Concerning glaucoma, the current study found low incidences of this complication in both groups as reported previously by Kim et al (who introduced a new pragmatic 6-standardised classification of glaucomas in ACIOL eyes. In the previous study, Megevand et al., found that ACIOLs (anterior chamber intraocular lenses) cause a shunt to an elevated IOP more frequently than posterior chamber IOLs because they occupy a space in the anterior chamber. In our study, however, IOP remained stable at all postoperative time points in both groups, suggesting that neither lens type may carry a risk advantage over another with modern surgical techniques [22]. We did not observe any significant difference in IOP between groups as the IOP was similar in both groups both preoperatively and on 1, 3 and 6 months post-operatively. The findings of this study corroborate the report by McGhee et al., that an earlier rise in the IOP post-operatively was linked with ACIOL as anterior chamber angle gets involved causing a possible angle-closure glaucoma [23]. Nevertheless, the fact that IOP remained stable in both groups, and the lenses could be implanted without the occurrence of complications, could indicate that the risk related to both lenses might have been offset by other improvements in surgical techniques, optimal placement of insertion of the lens and postoperative management. In addition, Pinto et al also reported similar results with our findings. Hecht et al., demonstrated insignificant differences in IOP between ACIOL and SFIOL groups after 6 months [24].

CONCLUSIONS

It was concluded that both lens types led to a notable upgrade in visual sharpness, without substantial differences between the groups. Both implants likewise exhibited comparable complication profiles, and internal eyeball pressure stayed balanced over the long run in both assemblages.

Authors Contribution

Conceptualization: FM
Methodology: FM, SMA
Formal analysis: NF
Writing review and editing: MAA

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

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