

Examine the Distant and Near Visual Outcomes after Phacoemulsification with Implantation of Accommodating versus Standard Intraocular Lenses

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ABSTRACT

Objective: To compare the visual outcomes after phacoemulsification with implantation of crystalens HD and Tek-clear as accommodating intraocular lenses versus SA60AT as standard intraocular lenses.

Study Design: Observational study

Place and Duration of Study: This study was conducted at the Department of Ophthalmology, DHQ Hospital Batkhela from July 2016 to December 2018.

Materials and Methods: A total of 36 eyes were enrolled. Patient's ages were > 35 years. Patients demographic were examined after taking informed consent. All the eyes were equally divided into three groups and implanted with three different intraocular lenses. Group A contains 12 eyes with crystalens HD, Group B contains 12 eyes with Tek-clear and Group C contain 12 eyes with SA60AT. Corrected, uncorrected and distant near visual acuity, near point of accommodation, spectacle freedom and satisfaction of patients were examined at 12 weeks postoperatively and compare the results between all groups.

Results: At follow up all the patients showed significant improvement in corrected distant visual acuity among all the groups. Uncorrected near visual acuity and distant corrected near visual acuity showed better outcomes in patients implanted with crystalens HD and Tek-clear. Near point of accommodation was closest in the crystalens HD group with p-value 0.002. Patients implanted with accommodating intraocular lenses showed better results regarding spectacle freedom and satisfaction with their near vision as compared to standard intraocular lenses.

Conclusion: The crystalens HD and Tek-clear intraocular lenses showed better outcomes regarding near vision and spectacle freedom as compared to monofocal intraocular lens.

Key Words: Cataract surgery, Accommodating, Standard Intraocular Lenses, Outcomes

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INTRODUCTION

Since the implantation of the first intraocular lens (IOL), attempts have been directed toward improvement of visual outcomes of cataract surgery. Loss of accommodation is inevitable with conventional monofocal IOLs and the first attempt to overcome this limitation was pseudophakic monovision.¹

Despite some reports of acceptable spectacle-free near and far visual acuity in more than half of the patients with monovision, this method may be associated with problems in stereoacuity, contrast sensitivity and dominance.² For lack of accommodation multifocal intraocular lenses are useful for pseudophakic cases.³ However these intraocular lenses reported some side effects such as glare disability, decreased contrast sensitivity and halos in eyes.⁴ Accommodating intraocular lenses were designed to avoid the optical side effects. Positional IOL was the 1st accommodating IOL with two types; single optic and dual optic. Single optic IOLs are based on axial (backward and forward) movement of the optic resulting from contraction and relaxation of the ciliary muscle, increasing the effective power of the IOL and thereby providing near focus.⁵ Many of single optics IOLs have been developed such as Tek-Clear, Crystalens HD and Tetraflex. The plate style single optic accommodating IOL Crystalens HD is designed to be implanted within the capsular bag and is made from third generation silicone (Biosil) which unlike other IOL materials does not have internal reflectivity. Crystalens HD showed better intermediate

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and near vision results with no procedural complications.⁶ According to the manufacturer, the IOL has a double mechanism to improve near visual function; first, axial movement of the optic which occurs with ciliary muscle changes and second, the radius of curvature of the anterior surface (arching optic) which varies with accommodative effort. A number of studies have shown better visual and accommodative results with this lens as compared to standard monofocal IOLs.^{7,8}

This study was conducted aimed to compare the visual outcomes after phacoemulsification with implantation of crystalens HD and Tek-clear as accommodating intraocular lenses versus SA60AT as standard intraocular lenses.

MATERIALS AND METHODS

This observational study was conducted at Department of Ophthalmology, DHQ Hospital Batkhela from 1st July 2016 to 31st December 2018. A total of 36 eyes of 33 patients of both genders whom were undergoing cataract extraction were enrolled in this study. Patient’s ages were >35 years. Patients demographic such as age, sex, medical history were examined after taking informed consent from all the patients. Exclusion criteria included more than one diopter (D) of keratometric astigmatism, incomplete or damaged zonules, any anterior segment pathology (e.g., chronic uveitis, rubeosis iridis, corneal dystrophy), controlled or undertreated glaucoma, retinal pathologies or history of retinal detachment, age-related macular degeneration, diabetic retinopathy, congenital cataracts, monocular status or previous ocular surgery in either eye. All the eyes were equally divided into three groups and implanted with three different intraocular lenses. Group A contains 12 eyes with crystalens HD, Group B contains 12 eyes with Tek-clear and Group C contains 12 eyes with SA60AT. Corrected, uncorrected and distant near visual acuity, near point of accommodation, spectacle freedom and satisfaction of patients were examined at 12 weeks postoperatively and compare the results between all groups. The data was analyzed using SPSS-20. Paired t-test was applied to compare the results between all groups. P-value <0.05 was considered as significant.

RESULTS

Out of 33 patients overall 24 (72.72%) patients were male (Group A 8, Group B 7, Group C 9) while rests 9 (27.28%) patients were females (Group A 3, Group B 3, Group C 3) with mean age were 57.6±10.8 years. 36 eyes of 33 patients were implanted with three different IOLs. Group A contains 12 eyes with crystalens HD, Group B contains 12 eyes with Tek-clear and Group C contains 12 eyes with SA60AT. There was no significant difference in demographic characteristics and preoperative measurements, including sphere,

cylinder, mean keratometry, axial length, uncorrected distance visual acuity (UCDVA), corrected distance visual acuity (CDVA), UCNVA and distance corrected near visual acuity (DCNVA) (Table 1).

Postoperatively all the patients showed significant improvement in corrected distant visual acuity among all the groups p-value 0.02 (Table 2). Uncorrected near and intermediate visual acuity and distant corrected near and intermediate visual acuity showed better outcomes in patients implanted with crystalens HD and Tek-clear p-value 0.002 as compared to Group C [SA60AT] (Table 3).

Table No.1: Distribution of genders in all groups

Gender	Group A	Group B	Group C
Male	8 (72.73%)	7 (70%)	9 (75%)
Female	3 (27.27%)	3 (30%)	3 (25%)

Table No.2: Mean values of postoperative refractive outcomes and distant visual acuity among all groups

Variable	Group A (12 eyes)	Group B (12 eyes)	Group C (12 eyes)
Sph (D)	0.16±2	-0.15±1.10	-0.12±0.5
Cydr (D)	-0.71±0.35	-0.98±0.40	-0.71±0.29
CDVA logMAR	0.03±0.10	0.07±0.10	0.07±0.08
UCDVA logMAR	0.17±0.11	0.25±0.12	0.27±0.12

P-value 0.02

Table No.3: At postoperative 12 weeks follow-up regarding intermediate and near acuities among all the groups

Characteristics	Group A (12 eyes)	Group B (12 eyes)	Group C (12 eyes)
UCNVA	0.13±0.15	0.19±0.16	0.35±0.10
DCNVA	0.17±0.18	0.27±0.20	0.50±0.2
UCIVA	0.16±0.15	0.23±0.14	0.40±0.12
DCIVA	0.14±0.16	0.23±0.16	0.53±0.13

P-value 0.002

Table No.4: Mean values of near point of accommodation between all the groups

Characteristic s	Group A (12 eyes)	Group B (12 eyes)	Group C (12 eyes)
NPA monocular cm	32.40±5.2	54.09±3.9	95.68±7.1
NPA monocular D	0	2	0
	2.85±0.40	1.98±0.19	1.12±0.10

P-value 0.02

Near point of accommodation was closest in the Group A (crystalens HD) group followed by Group B and C with p-value 0.002 (Table 4).

According to patient’s satisfaction regarding near vision among all groups, it was 90.91% in Group A, 70% in Group B and 50% in Group C. As per spectacle freedom in Group A, B and C the rate was 72.73%,

70% and 25% respectively. According to the complications, patients implanted with crystalens HD had a high rate of posterior capsule opacification that was found in 4 (33.33%) out of 12 eyes, 1 (8.33%) in Tek-clear group and 2 (16.67%) in SA60AT group (Tables 5-6).

Table No.5: Patients satisfaction regarding near vision and no need of spectacle

Characteristics	Group A (n=11)	Group B (n=10)	Group C (n=12)
Satisfied Near Vision			
Yes	10 (90.91%)	7 (70%)	6 (50%)
No	1 (9.09%)	3 (30%)	6 (50%)
Spectacles free			
Yes	8 (72.73%)	7 (70%)	3 (25%)
No	3 (27.27%)	3 (30%)	9 (75%)

P-value <0.05

Table No.6: According to the complications among all groups

Complication	Group A (12 eyes)	Group B (12 eyes)	Group C (12 eyes)
Yes	4 (33.33%)	1 (8.33%)	2 (16.67%)
No	8 (66.67%)	9 (75%)	10 (83.33%)

DISCUSSION

Functional near vision is indispensable due to the necessity of several near tasks in ordinary life. Loss of reading ability can greatly reduce quality of life. Thus, providing good near vision after cataract surgery is an important goal in modern cataract surgery.^{9,10} The present study compare the visual outcomes after phacoemulsification with implantation of crystalens HD and Tek-clear as accommodating intraocular lenses versus SA60AT as standard intraocular lenses. There was a significant improvement in distance vision after IOL implantation in all groups (Table 1). This is consistent with findings in previous studies on other positional accommodating IOLs as well as with cataract surgery expectations, and it confirms the safety of both accommodating IOLs used herein.^{11,12} There were also no statistically significant difference between the three IOL groups in terms of postoperative CDVA (Table 1). However, night vision and glare complaints were more frequently reported in eyes implanted with accommodating IOLs than with monofocal IOLs, but the difference was not significant. These findings indicate that both accommodating IOLs had similar capacity to successfully restore distance visual function after cataract surgery. Uncorrected near acuity values were best with the Crystalens HD. We observed that 58% of eyes with Crystalens HD, 35% of eyes with Tek-Clear and none of the eyes with SA60AT Monofocal IOL had uncorrected near acuity of 20/25 (J1) or better.

DCNVA improved significantly with both accommodating IOL groups in our study. Surprisingly, UCNVA and DCNVA also improved in the monofocal IOL group. A previous study demonstrated that the monofocal IOL we used in our study has some pseudo-accommodative ability, although the mechanism was not clearly understood.¹¹ The difference in DCNVA between the monofocal group (J6) and accommodating IOL groups, (Crystalens [J1 to J2]; Tek-Clear [J2 to J3]) was statistically significant, and the best DCNVA occurred in eyes implanted with the Crystalens HD (Table 2). In most reports, accommodating IOLs were associated with significant improvement in near visual acuity.^{8,12-16} Alió et al⁷ reported significant improvement in uncorrected and corrected near visual acuity with Crystalens HD as compared to a monofocal IOL. However, accommodating IOLs did not show any superiority to monovision or multifocal IOLs in some other studies.^{17,18} In one study, a dual optic accommodating IOL (Synchrony; AMO, CA, USA) showed better distant visual acuity and contrast sensitivity as compared to Crystalens HD; furthermore PCO and higher order aberrations were more common with the single optic Crystalens HD.^{19,20}

Saiki et al²¹ evaluated the long-term outcomes of the 1CU accommodating IOL. After 4 years, they found no significant change in CDVA, UCNVA, DCNVA, and subjective and objective accommodation amplitudes. In present study we found the outcomes according to the patient's satisfaction regarding near vision among all groups, it was 90.91% in Group A, 70% in Group B and 50% in Group C. As per spectacle freedom in Group A, B and C the rate was 72.73%, 70% and 25% respectively. All of the patients bilaterally implanted with accommodating IOLs (Crystalens or Tek-Clear) reported that they were very satisfied with their visual outcomes. Many of previous studies reported that spectacle freedom was also greater in patients with accommodating IOLs as compared to monofocal IOLs.^{20,21} In our study According to the complications, patients implanted with crystalens HD had a high rate of posterior capsule opacification that was found in 4 (33.33%) out of 12 eyes, 1 (8.33%) in Tek-clear group and 2 (16.67%) in SA60AT group. These results shows similarity to some previous studies.²² The square edge on the Crystalens IOL extends for only 240°; there is no square edge where the optic abuts the plates, while Tek-Clear and SA60AT both have 360° square edge design.

CONCLUSION

The crystalens HD and Tek-clear intraocular lenses showed better outcomes regarding near vision and spectacle freedom as compared to monofocal intraocular lens. Moreover, monofocal and accommodating IOLs in the present study restored distance visual function after cataract surgery. Both accommodating IOLs employed in this series yielded more ideal UCNVA and DCNVA than the monofocal IOL. The Crystalens HD showed better results than Tek-Clear.

Author's Contribution:

Concept & Design of Study: Muhammad Waseem
 Drafting: Abdul Ghafoor
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 Revisiting Critically: Muhammad Waseem
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Conflict of Interest: The study has no conflict of interest to declare by any author.

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