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A Retrospective Analysis of the Long-Term Safety and Efficacy of A1-UV Intraocular Lens Combined with Capsular Tension Ring in the Treatment of Patients with Cataract and Suspensory Ligament Abnormalities

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ABSTRACT

Objective: To evaluate the long-term safety and efficacy of the combination therapy of A1-UV Intraocular Lens (IOL) and Capsular Tension Ring (CTR) for cataract patients with abnormal suspensory ligaments.

Method: Retrospective data analysis. Extract all patient information related to A1-UV IOL and 920H IOL from the existing Clinical Trial Database of CTR to form a new dataset. The new dataset focuses on IOL and the clinical safety and efficacy of A1-UV IOL and 920H IOL combined with CTR was compared and analyzed based on it. The follow-up time points include 1-2 days, 1 week, 1 month, 3 months, 6 months and 1 year. Evaluation indicators include Best-Corrected Distance Visual Acuity (BCDVA), Uncorrected Distance Visual Acuity (UCDVA), spherical power, cylindrical power, Equivalent Spherical power (SE), Intraocular Pressure (IOP), corneal endothelial cell density, inflammatory response, Adverse Events (AE) and Serious Adverse Events (SAE). Statistical analysis was conducted using SPSS 22.0 software. All statistical tests are conducted using a two-sided test, and a P-value less than 0.05 is considered statistically significant for the difference being tested. Compare the quantitative data using t-test or Wilcoxon rank-sum test. Compare count data using chi-square test or Fisher's exact probability.

Results: The number of cases in the A1-UV group and 920H group were both 27 (monocular), with an average age of 68.46 ± 6.93 years old and 70.27 ± 10.95 years old, respectively. The sample sizes at 6 months and 1 year after surgery were 26 cases (96.30%) and 21 cases (77.77%) in the A1-UV group, respectively, while the 920H group consisted of 26 cases (96.30%) and 22 cases (81.48%), respectively. The use of two types of IOLs combined with CTRs can significantly improve BCDVA and UCDVA (both $P<0.05$). The differences between the groups during each follow-up period were not statistically significant (all $P>0.05$). The average residual spherical power, residual cylindrical power, and residual SE of both groups of patients after surgery were close to emmetropic eye. There was no statistically significant difference ($P>0.05$) in the comparison of other refraction indicators between the groups during each follow-up period, except for the cylindrical power at 3 months and 1 year after surgery. In the A1-UV group, a total of 2 patients experienced 3 episodes of mild IOP elevation, which was judged by the investigator to be unrelated to IOL, and no drug treatment was used, and it recovered spontaneously. 3 patients in the 920H group experienced three episodes of high IOP, including two mild cases (one possibly related to the IOL) and one moderate case (possibly related to the IOL), all of which were controlled by medication and recovered. In addition, the IOP of the remaining patients during each follow-up period after surgery was within the normal range. There was no AE or SAE related to implanted products in the A1-UV group.

Conclusion: The combination of A1-UV IOL and CTR has long-term good safety and efficacy in the treatment of complex cataract patients with suspensory ligament abnormalities.

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Introduction

Cataract is a disease that occurs on the crystalline lens of the eye, and any opacity of the lens can be called a cataract. Due to the turbidity of the natural crystalline lens in the eye, it hinders light from entering the eye, thereby affecting visual acuity and even blindness. Cataract, as a common cause of blindness, has not yet been effectively suppressed or prevented from developing by any medication. Only surgery [i.e. cataract extraction combined with Intraocular Lens (IOL) implantation] can be used to restore the patient's visual acuity.

Fragile or rupture of the suspensory ligament, posterior capsule wrinkle, and capsule contraction caused by trauma, congenital or other factors are more common in clinical practice. When the range of suspensory ligament rupture is greater than one quadrant, conventional methods are difficult to handle [1]. Early literature listed lens subluxation as a contraindication for phacoemulsification of cataracts [2], for the reason that when lens subluxation occurs, the partial rupture of the suspensory ligament makes the lens lose stability, and in the process of emulsification suction, it may cause the expansion of the suspensory ligament rupture range and the prolapse of the vitreous, which makes the operation more difficult and the complications increase [3,4].

The application of Capsular Tension Ring (CTR) has effectively solved the above problems. For patients with preoperative or intraoperative suspensory ligament rupture, fragile suspensory ligament with the risk of capsule wrinkling, and unstable suspensory ligament relaxation, CTR can center the IOL that is offset from the center of the pupil, support the capsule at the site of suspensory ligament rupture, reduce posterior capsule wrinkle, keep the pouch physiologically round, resist capsule contraction, etc., so as to facilitate the smooth progress of phacoemulsification and cortical aspiration in cataract surgery, and also avoid complications such as IOL displacement caused by postoperative capsule contraction [5,6].

Since 1993, Legler and Witsche pioneered the successful application of CTR in cataract surgery, effectively solving the problems of IOL implantation and deviation, CTR has undergone more than 30 years of development[7]. CTR is widely recognized by clinical experts as an effective cataract surgery aid for the safe conduct of cataract surgery, broadening the scope of application of posterior chamber IOL implantation, simplifying complex cataract surgery, and being an effective cataract surgical aid[8]. Although the CTR has a long history and wide range of clinical applications as an adjunct to cataract surgery, there are few long-term studies on it.

Previous studies have shown that the A1-UV type aspherical IOL, as the first domestically produced hydrophobic IOL, has good safety and efficacy [9,10]. But there have been no public reports on its combination with a CTR. From this perspective, the study evaluates the long-term safety and efficacy of A1-UV IOL combined with CTR in the treatment of cataract patients with suspensory ligament abnormalities through retrospective data analysis.

Data and Methods

Object

The data of this study is from a pre-market clinical trial of a CTR (hereinafter referred to as the "original study") [11]. The original study focused on the CTR, in which adult patients with cataract surgery and CTR implantation indications who were scheduled to undergo phacoemulsification extraction combined with CTR and IOL implantation were randomly implanted with CTR-type capsular tension ring [Eyebright Medical Technology (Beijing) Co., Ltd.] or TENSIOBAG-type capsular tension ring (Carl Zeiss Medical Technology Co., Ltd.). The material (PMMA material), structure (open one-piece), implantation method (implantation through CTR implantation system), implantation location (capsular bag), and indication (for IOL implantation in cataract patients to maintain capsular tension, prevent posterior capsule wrinkle, and resist capsule contraction) of two CTRs are the same, and clinical studies have found that the safety and efficacy of the two CTRs are also consistent [11,12].

The inclusion and exclusion criteria for the original studies were as follows:

Inclusion criteria

- Adult, no gender limitation
- Cataract patients who are expected to undergo phacoemulsification extraction combined with CTR and IOL implantation
- The nuclear hardness of the surgical eye is 1~3
- Able to understand the purpose of the trial, voluntarily participate and have the informed consent form signed by the patient himself or his legal guardian.

Exclusion Criteria

- Patients with other eye diseases in the surgical eye, or those with contraindications to the implantation of CTR or intraocular surgery, such as congenital cataract, patients with microphthalmia, children under 12 months of age, corneal dystrophy or endothelial cell insufficiency, chronic uveitis, active eye disease (active stage of diabetic retinopathy, uncontrollable glaucoma), fragile capsule, suspensory ligament rupture more than 120° range, etc.
- Patients with severe or unstable heart, liver, kidney, lung, endocrine (including thyroid insufficiency), blood, psychiatric and neurological dysfunction and other diseases
- Patients with a history of retinal detachment or retinopathy in the surgical eye
- ECG or laboratory findings suggest that the patient has a contraindication to surgery
- Patients who have had intraocular surgery within the past 3 months
- Patients who are expected to have a postoperative BCDVA of less than 20/40
- Patients requiring combined ocular surgery
- Patients who have participated in clinical trials of drugs or medical devices within 30 days prior to screening
- Patients who are using or need to use ocular or systemic drugs that may affect their vision during the study
- Pregnant or lactating women
- Patients who have no visual function in the contralateral eye as judged by the investigator
- Other conditions judged by the investigator that the patient is not suitable for enrollment.

In the original study, the clinical data of IOLs were collected, but the type of IOL was not limited, and doctors chose to implant different types of IOLs according to clinical practice experience and patients' wishes in the actual diagnosis and treatment environment, so more than 10 models of IOLs were involved. The most commonly used IOL among them were A1-UV IOL [Eyebright Medical Technology (Beijing) Co., Ltd.] and 920H IOL (Rayner, UK), both of which were used in 27 cases (monocular). Both are foldable one-piece monofocal aspheric IOL, the A1-UV IOL is made of hydrophobic acrylate material, modified L loop, optical zone diameter 6.0mm, total diameter 12.0mm, and 920H type IOL is hydrophilic acrylic material, C loop, optical zone diameter 6.25mm, total diameter 12.50mm.

All patient information implanted with A1-UV IOL and 920H IOL was extracted from the database of the original study to form a new dataset. The new dataset focuses on IOL. Based on the new dataset, the clinical safety and efficacy of A1-UV IOL and 920H IOL combined with CTR was compared and analyzed.

Since this study is only a secondary analysis of the original study, it does not change the original diagnosis and treatment plan of the patient and does not collect new data, so it does not involve ethical review.

Method

- **Surgical Operations:** All surgeries are performed by ophthalmologists, and the surgical procedures follow the standard operating procedures and usage methods in the instructions and surgical technical guidelines. To reduce the impact of viscoelastic agents, implant systems, and intraocular perfusion required for surgical procedures on the safety and efficacy of the test product, it is recommended that each research center unify before the start of the trial.

- **Observation Indicators:** Best-Corrected Distance Visual Acuity (BCDVA), Uncorrected Distance Visual Acuity (UCDVA), spherical power, cylindrical power, Equivalent Spherical power (SE), Intraocular Pressure (IOP), corneal endothelial cell density, slit lamp examination for inflammatory reactions (including but not limited to corneal edema, conjunctival edema, conjunctival congestion, aqueous humor flash, aqueous humor cells, suspensory ligaments, pupil, iris, anterior capsule, posterior capsule, retina, IOL and IOL position), Adverse Events (AE) and Serious Adverse Events (SAE) at 1-2 days, 1 week, 3 months, 6 months and 1 year postoperatively.
- **Statistical Analysis:** SPSS22.0 software was used for statistical analysis. All statistical tests were performed using a two-sided test, and a *P* value of less than 0.05 would be considered statistically significant. The mean and standard deviation will be calculated for the description of quantitative indicators, and the number and percentage of cases and percentages for each category will be described for categorical indicators. For the normally distributed variables, the t-test was used to compare the measurement data. For the non-normally distributed variables, the Wilcoxon rank-sum test was used to compare the continuous data. Comparison of counts using chi-square test or Fisher's exact probability.

Result

Demographic Data

The average ages of the A1-UV group and 920H group were 68.46 ± 6.93 years old (range from 56.02 to 79.21 years old) and 70.27 ± 10.95 years old (range from 36.79 to 83.79 years old), respectively. There were no statistically significant differences in age, gender, Anterior Chamber Depth (ACD), corneal curvature, and natural lens nucleus hardness among the groups of subjects (all $P>0.05$), and they were balanced and comparable (Table 1). The sample sizes at 6 months and 1 year after surgery were 26 cases (96.30%) and 21 cases (77.77%) in the A1-UV group, respectively, while the 920H group consisted of 26 cases (96.30%) and 22 cases (81.48%), respectively.

Table 1: Demographic Data of Subjects

Group	Case number	Age (years old)	Gender (n)		Anterior chamber depth (mm)	Corneal curvature (D)	Natural lens nucleus hardness (n)				
							Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
A1-UV	27	68.46±6.93	9	18	2.89±0.35	43.81±2.06	0	7	19	1	0
920H	27	70.27±10.95	12	15	3.09±0.41	43.95±1.55	1	12	14	0	0
Test value	/	-1.410	0.701		0.483	1.754	4.073				
P value	/	0.159	0.402		0.490	0.191	0.254				

Visual Acuity

Implantation of A1-UV IOL or 920H IOL can significantly improve the BCDVA and UCDVA of the subjects. The postoperative visual acuity is significantly improved compared to preoperative visual acuity (both $P<0.05$), and the BCDVA and UCDVA of the subjects can be maintained at a high level one year after surgery. The differences between the groups during each follow-up period were not statistically significant (all $P>0.05$). See Table 2.

At 6 months after surgery, there were 22 patients (84.62%) in the A1-UV group and 21 (80.77%) in the 920H group with BCDVA of not less than 0.1 LogMAR. One year after operation, there were 19 cases (90.48%) in the A1-UV group and 18 cases (81.82%) in the 920H group, respectively. At 6 months after surgery, there were 25 patients (96.15%) in the A1-UV group and 26 patients (100.00%) in the 920H group with the BCDVA of not less than 0.2 LogMAR. One year after operation, there were 21 cases (100.00%) in the A1-UV group and 22 cases (100.00%) in the 920H group, respectively. At 6 months and 1 year after surgery, all patients (100%) in both groups had a BCDVA of not less than 0.3 LogMAR.

UCDVA refers to the best visual acuity that the eye can achieve without any optical correction (e.g., glasses, contact lenses). Because patients have varying degrees of residual SE after surgery, which prevents light from being accurately focused on the retina, UCDVA is slightly lower than that of BCDVA.

At 6 months after surgery, 16 cases (61.54%) in the A1-UV group and 14 cases (53.85%) in the 920H group had UCDVA of not less than 0.1LogMAR. One year after operation, there were 9 cases (42.86%) in the A1-UV group and 11 cases (50.00%) in the 920H group, respectively. At 6 months after surgery, there were 22 cases (84.62%) in the A1-UV group and 16 cases (61.54%) in the 920H group with UCDVA of not less than 0.2LogMAR visual acuity. One year after operation, there were 18 cases (85.71%) in the A1-UV group and 15 cases (68.18%) in the 920H group. At 6 months after operation, 25 cases (96.15%) in the A1-UV group and 20 cases (76.92%) in the 920H group had UCDVA of not less than 0.3LogMAR. One year after operation, there were 20 cases (95.24%) in the A1-UV group and 17 cases (77.27%) in the 920H group, respectively.

Table 2: LogMAR Visual Acuity at Different Follow-Up Time Points before and after Surgery-BCDVA

Group	Baseline	1-2 Days	1 Week	1 Month	3 Months	6 Months	1 Year
A1-UV	0.37±0.27	0.23±0.27	0.10±0.13	0.08±0.08	0.07±0.06	0.07±0.09	0.02±0.10
920H	0.49±0.36	0.23±0.22	0.12±0.13	0.10±0.13	0.09±0.12	0.07±0.08	0.07±0.08
Test value	-1.269	-0.794	-0.710	-0.092	-1.171	-0.208	-1.453
P value	0.204	0.427	0.477	0.926	0.865	0.835	0.146

Table 3: LogMAR Visual Acuity at Different Follow-Up Time Points before and after Surgery - UCDVA

Group	Baseline	1-2 Days	1 Week	1 Month	3 Months	6 Months	1 Year
A1-UV	0.64±0.30	0.31±0.26	0.16±0.14	0.14±0.11	0.13±0.08	0.14±0.12	0.16±0.12
920H	0.75±0.41	0.32±0.28	0.20±0.22	0.17±0.22	0.17±0.22	0.18±0.20	0.20±0.18
Test value	3.243	-0.079	-0.273	-0.320	-0.018	-0.104	-0.413
P value	0.078	0.937	0.784	0.749	0.986	0.918	0.680

Optometry

Since the target diopter of 0 was not required in the original study, the doctor can reserve the diopter according to the actual clinical situation and the patient's wishes, the individual differences in residual diopter may be large, resulting in this index can only be used as a reference and is not used as the main basis for evaluating the performance of IOL. However, on the whole, the average values of postoperative residual spherical power, residual cylindrical power and residual SE of the two groups were close to 0, that is, the postoperative refractive status of the patients was close to that of the emmetropic eye. Except for the cylindrical power at 3 months and 1 year after surgery, there was no significant difference in the other indexes between the groups in the follow-up period (all P>0.05) (See Table 4~6).

Table 4: Optometry at Different Follow-Up Time Points before and after Surgery - Spherical Power (D)

Group	Baseline	1-2 Days	1 Week	1 Month	3 Months	6 Months	1 Year
A1-UV	0.46±2.60	0.58±1.04	0.68±0.79	0.40±0.67	0.50±0.73	0.38±0.58	0.23±0.51
920H	-2.46±7.94	0.20±1.39	0.28±1.24	0.15±1.14	-0.02±1.31	0.15±1.35	-0.01±1.38
Test value	-0.761	1.287	-0.677	-0.235	-0.950	-0.157	-0.393
P value	0.447	0.262	0.498	0.814	0.342	0.875	0.694

Table 5: Optometry at Different Follow-Up Time Points before and after Surgery-Cylindrical Degree (D)

Group	Baseline	1-2 Days	1 Week	1 Month	3 Months	6 Months	1 Year
A1-UV	-1.11±1.00	-0.91±0.68	-1.00±0.68	-0.97±0.58	-0.99±0.56	-0.77±0.64	-0.31±0.75
920H	-1.67±1.59	-0.96±0.68	-0.99±0.65	-0.77±0.36	-0.57±0.53	-0.78±0.40	-0.70±0.41
Test value	-1.224	-0.009	0.691	-1.536	-2.368	-0.540	-2.285
P value	0.221	0.993	0.410	0.124	0.018	0.589	0.022

Table 6: Optometry at Different Follow-Up Time Points before and after Surgery- Diopter (D)

Group	Baseline	1-2 Days	1 Week	1 Month	3 Months	6 Months	1 Year
A1-UV	-0.09±2.56	0.12±1.06	0.18±0.66	-0.09±0.63	0.00±0.59	-0.01±0.64	0.07±0.48
920H	-3.29±7.91	-0.28±1.39	-0.22±1.27	-0.23±1.07	-0.31±1.31	-0.24±1.38	-0.36±1.37
Test value	-1.072	-0.855	-0.780	-0.078	-0.062	-0.285	-0.317
P value	0.284	0.392	0.436	0.938	0.950	0.776	0.751

IOP

Transient IOP elevation occurred in both groups in the early postoperative period, and was recorded as AE in this study. A total of 2 patients in the A1-UV group had 3 episodes of intraocular hypertension, all of which were mild, and the investigator judged that none of them were related to the IOL, and they were possibly/definitely related to surgery, and none of them were treated with medication, and the outcomes were all recovery. A total of 3 patients in the 920H group had 3 episodes of intraocular hypertension, of which 2 were mild (1 case was not related to the IOL and may be related to surgery; One case may be related to both the IOL and surgery), and one case is moderate (may be related to both the IOL and surgery), and all recovered with medication.

There were statistically significant differences between the A1-UV group and the 920H group at each follow-up time point (all P<0.05), and the IOP of the subjects in the A1-UV group was relatively high, but except for the patients with high IOP AE, the rest of the patients were within the normal range. One year after surgery, the mean IOP of the subjects implanted with A1-UV was 14.45 mmHg, and the mean difference from baseline was -0.31 mmHg (See Table 7).

Table 7: Intraoperative and Postoperative Eye Pressure at Different Follow Up Time Points

Group	Baseline	1-2 Days	1 Week	1 Month	3 Months	6 Months	1 Year
A1-UV	14.78±3.26	15.63±4.35	15.03±3.15	14.89±3.22	14.26±2.48	14.99±3.39	14.45±2.38
920H	12.46±3.07	14.06±6.50	10.31±2.53	10.56±2.56	10.96±2.93	11.75±2.75	12.22±2.87
Test value	0.011	-2.184	-4.804	-4.408	-3.824	-3.754	-2.524
P value	0.916	0.029	<0.001	<0.001	<0.001	<0.001	0.012

Corneal Endothelial Cell Density

One year after surgery, the corneal endothelial cell density in the A1-UV group was 2072.94 ± 478.02 cells/mm^2, while the corneal endothelial cell density in the 920H group was 2222.41 ± 512.79 cells/mm^2. There was no statistically significant difference between the groups (t=-0.988, P=0.329).

Adverse Events

The surgical implantation process was smooth, and there were no cases of rupture of the posterior capsule or the suspensory capsule during surgery. During the study, the position of the IOL was centered, and no abnormalities such as tilt, deviation, or dislocation occurred. No capsule contraction was found. Only a few patients experienced mild anterior chamber inflammation, which quickly recovered after symptomatic treatment and did not have any adverse effects on the eyes.

In this study, there were no AE or Serious Adverse Events (SAE) related to the implanted product in the A1-UV group. In addition to the above-mentioned AE of high IOP, other ocular AE in the A1-UV group included

- 9 episodes of dry eye in 8 patients, all of which were mild, and most of the outcomes were recovery after drug treatment
- 1 patient was hospitalized for cataract in the contralateral eye and was counted as a second operation. No PCO requiring surgical treatment occurred.

There was no SAE related to implanted products in the 920H group. In addition to the above-mentioned high IOP AE, other ocular AE included

- 1 patient had one dry eye, the degree was mild, and the investigator judged that it was unrelated to the IOL, and the patient recovered on his own.
- 2 patients had two PCOs, both of which were mild, one of them recovered after outpatient surgery, and one patient was untreated.
- 2 patients had 3 abnormal conditions of eye redness, itching, foreign body sensation or increased discharge, all of which were mild, and were judged by the investigator to have no relationship to do with the IOL, and all recovered after drug control.
- 1 patient had one conjunctival hyperemia, the degree was mild, and the investigator judged that it had no relationship to do with the IOL, and recovered after outpatient treatment and drug control.

Discussion

Many factors can weaken the function of the suspensory ligament of the crystalline lens, such as Mature cataracts, vitrectomy, high myopia, aging, pseudoexfoliation syndrome, retinitis pigmentosa, Marfan syndrome, eye damage, etc [13,14]. These patients are at an increased risk of developing capsule loosening, anterior chamber instability, and lens dislocation during cataract surgery. There is also a higher chance of capsule contraction after surgery, which increases the tension of the suspensory ligament fibers, further lengthening and weakening them. Compared with IOL implantation in the anterior chamber, ciliary sulcus, or sutured to the iris or sclera, the difficulty, time, and risk of co implantation of a CTR are lower [13]. The CTR can maintain the circular contour of the capsular bag, balance the tension of the suspensory ligament fibers, support the relaxed area of the suspensory ligament, provide sufficient surgical space inside the capsular bag, and thus improve surgical safety [15,16]. At the same time, it reduces the risk of complications such as capsule contraction, IOL misalignment or dislocation, and vitreous prolapse, improves the stability of the position of the IOL, and is beneficial for the recovery of patients' visual acuity [17,18]. Although the combined use of CTR makes the surgical process more complex compared to conventional cataract surgery, requiring doctors to have higher technical skills and experience, the application of CTRs has less impact on IOP and corneal endothelial cells, and does not increase the risk of intraocular infection or postoperative complications [19,20].

The long-term effects of CTR in cataract surgery are mainly reflected in the following aspects

• **Maintaining the Stability of the Capsule:** CTR can maintain the circular contour of the lens capsule for a long time, providing a stable support environment for the IOL, reducing the axial movement of the IOL after surgery, and thereby improving the position stability of the IOL. During the 1-year follow-up period after surgery in this study, both groups of IOLs were in the center position, and no abnormal position such as tilt, eccentricity, or dislocation of the IOLs occurred. It can be seen that the CTR can effectively maintain the stability of the capsule.

• **Reduce Capsule Contraction:** CTR provides sufficient tension to the anterior capsule to counteract its own contraction, preventing the anterior capsule opening from shrinking and IOL displacement [21]. During the 1-year follow-up period after surgery in this study, no cases of capsule contraction occurred. It was observed that CTR can effectively inhibit capsule contraction.

• **Reduce the Incidence of Posterior Capsule Opacity (PCO):** CTR can inhibit the migration and proliferation of residual lens epithelial cells after cataract surgery, reduce the occurrence of PCO, and lower the risk of requiring Nd: YAG laser treatment. During the one-year follow-up period after surgery in this study, there were individual cases of PCO in both groups, but except for one patient in group 920H who had PCO requiring YAG laser treatment, the remaining patients had mild PCO and did not progress to the optic axis, and did not affect the visual acuity, which showed that the CTR can effectively reduce the incidence of PCO.

• **Improving Visual Acuity:** In this study, implantation of A1-UV IOL or 920H IOL significantly improved the subjects' BCDVA and UCDVA, and postoperative visual acuity was significantly improved compared to preoperative visual acuity (both $P<0.05$); One year after surgery, both the BCDVA and UCDVA of the subjects remained at a high level, with the vast majority of subjects achieving a UCDVA of 0.3 LogMAR, and 100.00% of subjects achieving a BCDVA of 0.3 LogMAR. It can be seen that by maintaining the stability of IOL and reducing the occurrence of PCO, CTR can help improve postoperative visual acuity.

• **Reducing Refractive Drift:** In this study, the average residual spherical power, residual cylindrical power, and residual SE of

the two groups of patients after surgery were close to 0, indicating that the postoperative refractive status of the patients was close to that of the emmetropic eye. It can be seen that CTR can improve postoperative refractive status, stabilize postoperative refractive error, and reduce refractive drift.

• **No Additional Risks Introduced:** Patients who require the combined implantation of a CTR in cataract surgery tend to be worse off and have a worse recovery after surgery. However, in this study, during the 1-year follow-up period after surgery, IOP and corneal endothelial cells were normal, indicating that the use of a CTR in the capsule did not introduce any additional risks.

In summary, CTR has a positive long-term effect in cataract surgery, providing patients with more stable postoperative visual acuity and reducing the risk of complications. Comparative analysis with Rayner 920H shows that the combination of A1-UV IOL with CTR has long-term good safety and efficacy in treating complex cataract patients with suspensory ligament abnormalities.

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