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Description of Visual Acuity and Refractive Arrangements in Patients Post Cataract Operation at Jec Orbita Makassar Eye Hospital in 2022

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ABSTRACT
Survey results show that the main cause of blindness is cataracts. The only definitive therapy for cataract patients is surgery. However, not all patients who have undergone surgery will achieve the desired visual improvement and therefore affect the patient's quality of life. Objective : To determine the description of visual acuity before and after surgery as well as the successness of biometry measurements and the refractive errors in patients after cataract surgery at the JEC-Orbita Makassar Eye Hospital in 2022. This research is a descriptive study using secondary data from the medical records of patients who have had cataract surgery at the JEC-Orbita Makassar Eye Hospital in 2022. Results: Visual acuity before cataract surgery was mostly blind (40.9%), the first day after surgery was mostly blind (32.3%), on the seventh day after surgery was mostly normal vision (43%), and on the thirtieth day after surgery mostly normal vision (68.8%). The refractive errors found were 17.2% hypermetropia, 10.8% simple hypermetropia astigmatism, 9.7% simple myopia astigmatism, 9.7% myopic astigmatism, 8.6% compound hypermetropia astigmatism, and 1.1% myopia. The visual acuity after refractive errors correction was mostly normal (90.6%). The average intraocular lens (IOL) used was 20.48 D (target refraction -0.20 ± 0.18 D, prediction error -0.41 ± 0.61 D). Conclusion: Visual acuity after cataract surgery, especially on the thirtieth day after surgery, shows significant improvement compared to visual acuity before surgery with post-operative refractive errors shows mostly hypermetropia. The prediction error value (indicator of the successness of biometric measurement) is -0.41 ± 0.61 D, in accordance with the average prediction error value that is common in adult eyes.

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INTRODUCTION

Cataract is any cloudiness that occurs in the lens. This cloudiness will interfere with the process of sending light rays to the retina, thereby disrupting vision. Cataract is a progressive lens disorder and is one of the most common causes of blindness throughout the world. Many factors are thought to play a role in the occurrence of cataracts, such as

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the aging process, excessive exposure to ultraviolet light or other radiation, trauma, toxins, systemic diseases (eg diabetes and hypertension), smoking, and heredity. However, based on research, aging is the most common cause of cataracts.

Various studies state that the prevalence of cataracts in individuals aged 65-74 years is 50%, this prevalence increases to 70% in individuals over 75 years. This happens because in old age, the main protein that makes up lens fibers, crystalline, which under normal circumstances is transparent undergoes a denaturation process so that the lens experiences cloudiness. Additional findings related to the pathogenesis of cataract formation may be vesicles between the lens fibers or epithelial cell migration and aberrant enlargement of the epithelial cells.

Cataracts can be classified based on the degree of hardness of the nucleus giving different visual acuity (Buratto classification), viz:

a. Grade 1: The nucleus is soft and appears slightly cloudy with a slightly whitish color, visual acuity is better than 6/12 or 20/40, fundus reflex is clear.
b. Grade 2: Nucleus with mild turbidity and a yellowish appearance, visual acuity 6/12-6/30 or 20/40-20/100, clear fundus reflex.
c. Grade 3: The nucleus has moderate turbidity and appears yellow in color accompanied by grayish cortical opacities, visual acuity between 6/30-3/60 or 20/100-20/400, good fundus reflexes.
d. Grade 4: The nucleus is hard and brownish yellow, visual acuity 3/60-1/60, little fundus reflex.
e. Grade 5: The nucleus is very hard and brownish to slightly blackish in color, visual acuity is worse than 1/60, fundus reflex is absent. This cataract is also called brunescent cataract or black cataract.

The choice of therapy for cataracts is based on how severe the clouding or maturity of the lens is to the point that it can cause difficulty in carrying out daily activities. 2 If the patient's visual acuity is 6/24 or better, or pupil dilation is 2.5%, administration of phenylephrine or refractive glasses can provide improvements for patients to be able to carry out their daily activities. However, if the patient's visual acuity is worse than 6/24 or there are medical indications (such as: phacolytic glaucoma, phacomorphic glaucoma, and retinal detachment) accompanying cataracts, surgery can be performed.

Cataract surgery technology has greatly improved with the introduction of microsurgical equipment, intraocular lenses, and changes in local anesthetic techniques, providing better postoperative vision with a shorter postoperative recovery period. 1 However, not all patients have undergone this. Surgery will achieve the desired vision improvement and often leaves residue in the form of refractive errors.

There are several factors that influence visual acuity and refractive errors in patients after cataract surgery. These factors are divided into pre-operative, intra-operative and post-operative factors. One of the pre-operative factors that causes many refractive errors is errors in measuring eye biometry and therefore errors in determining IOL power. Biometry helps predict the power of the IOL to be implanted. Biometric measurements to determine accurate IOL estimation along with spectacle correction can promote better

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visual outcomes. Another pre-operative factor that plays a role is the presence of abnormalities on the surface of the eyeball. These disorders include keratoconjunctivitis sicca, keratitis, ABMD (anterior basement membrane disease), and Salzmann's nodular degeneration. These conditions cause an irregular ocular surface and therefore can affect the accuracy of corneal power measurements. A similar thing also occurs with astigmatism due to scars on the cornea or ectasia. It is important to identify and treat these conditions before surgery so that post-operative refractive errors that can affect patient satisfaction and quality of life can be avoided. A history of previous keratorefractive surgery also needs to be identified because keratometry values are determined by the curvature of the cornea.

Another pre-operative factor that plays a significant role is the maturity of the cataract. Overmature or hypermature cataracts may be associated with complications of cataract such as secondary glaucoma and make identification of comorbidities more difficult and may lead to biometric contraindications that may worsen visual outcomes. The hard size and density of the lens often causes adhesions, glaucoma, uveitis and lens dislocation, resulting in sub-optimal post-operative visual acuity. In hypermature cataracts, a degenerative process occurs in the lens or lens cortex which causes the lens cortex to melt, the melted lens will come out into the anterior chamber, the lens material in the anterior chamber can block the exit of the anterior chamber fluid and cause phacolytic glaucoma. The degenerative process can also absorb fluid into the lens and cause the lens to swell. A swollen lens causes the iris to be pushed forward, the eye chamber becomes shallow, and the corner of the eye chamber narrows or even closes and secondary glaucoma occurs.

This is in line with the results of research by Anak Agung et al (2019) which also states that the type or maturity of cataract affects visual acuity after cataract surgery, where poor outcomes tend to be experienced by the group of subjects with mature senile cataracts compared to immature senile cataracts, namely with a proportion of 9, 1%.

Apart from several pre-operative factors mentioned above, research results which state that there is a relationship between age and visual acuity after cataract surgery cannot be ignored and can be considered as a pre-operative factor. The older the patient, the more likely there are other eye diseases that accompany cataracts, such as macular degeneration and decreased retinal thickness. In addition, as you get older, the risk of experiencing surgical complications increases. The most common complications in old age are posterior capsule perforation and cystoid macular edema.

Intra-operative factors which include intra-operative complications also influence visual acuity after cataract surgery. Intraoperative complications that often occur include vitreous prolapse and posterior capsule tear. This complication occurs more frequently with the ECCE technique compared with the phacoemulsification technique.

Post-operative factors that are considered to play a significant role are the emergence of post-operative complications. A study conducted in Ghana (2022) explained that postoperative complications were the most important factor in causing poor visual acuity results in patients after cataract surgery, one of which was vitreous loss. This is in accordance with the results of research conducted by Rizki et al (2019) on patients after cataract surgery using extracapsular cataract extraction techniques, which stated that post-

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operative visual acuity was influenced by the emergence of post-operative complications (p = 0.043). Postoperative complications vary for each surgical technique. Surgical techniques that require large incisions can increase the incidence of astigmatism. This is the reason why the ECCE technique has a higher risk of causing astigmatism compared to the SICS technique. However, in several conditions such as pseudoexfoliation, hypermature cataracts that have a thin posterior capsule, and mild phacodonesis, the ECCE surgical technique is more recommended because the SICS surgical technique is not completely safe. Apart from that, SICS and phacoemulsification also have a higher risk of developing corneal edema and causing bullous keratopathy. Corneal edema occurs due to inflammation or injury to the corneal endothelium during cataract surgery, mechanical trauma or caused by the toxic effects of using solutions for irrigation. The cornea is one of the refractive media, in conditions of corneal edema caused by injury to the corneal endothelium it can interfere with the light refraction process which can cause a sharp decrease in vision. Another complication is the presence of residual cortex due to failure to aspirate properly, which can interfere with vision if it is located in the visual axis. Apart from that, other complications that can be found are macular edema, increased ocular pressure or glaucoma.

Another post-operative factor is a shift in the position of the IOL. Although this condition is unlikely to occur within a short time after surgery because it is a condition that occurs when the original fluid accumulation in the capsular bag behind the IOL pushes the IOL forward. This can cause nearsightedness in the future.

A study conducted by Venkatesh (2010) regarding the comparison of phacoemulsification and SICS techniques for cataracts showed that post-operative visual acuity <2/200 (poor outcome) tended to occur more frequently in the group undergoing the SICS procedure, namely with a proportion of 1.7%, while visual acuity improvement 20/20 – 20/30 (good outcome) tends to be more common in the group that underwent a phacoemulsification procedure, namely with a proportion of 45.1%. From this study it can be concluded that the phacoemulsification surgical method has a slightly better UDVA (Uncorrected distance visual acuity) compared to the group that underwent the SICS procedure. The results of this research are in line with the results of research conducted by Anak Agung et al. (2019) that poor outcomes are more common in patients who undergo SICS surgery compared to phacoemulsification.

METHOD

This research is a quantitative descriptive study conducted at the JEC-Orbita Makassar Eye Hospital, Jl. A.P. Pettarani No. 186, Banta-Bantaeng, Kec. Rappocini, Makassar City, South Sulawesi in December 2023. The data used in this study is secondary data from the medical records of patients who underwent cataract surgery at the JEC-Orbita Makassar Eye Hospital in 2022 with one operating operator. This study involved 93 cataract operations from 77 cataract patients and was selected based on a probability sampling-simple random sampling technique. After the data is collected, the data will be managed statistically-descriptively using SPSS software and presented in the form of frequency distributions and percentages.

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RESULTS AND DISCUSSION

Based on research that has been carried out to determine the description of visual acuity and refractive errors in patients after cataract surgery at JEC Orbita Eye Hospital Makassar in 2022, researchers can describe the results of the research as follows:

Patient Demographic Data Characteristics

Table 1. Characteristics of demographic data of research subjects

Characteristics	Frequency	Percentage	Mean ± SD
Age Group (n = 77)			
Early Adulthood (26-35 years)	1	1.3 %	
Late Adulthood (36-45 years)	4	5.2 %	
Early Elderly (46–55 years)	7	9.1 %	66.25 ± 10.34
Late Elderly (56-65 years)	21	27.3 %	
Seniors (>65 years)	44	57.1 %	
Gender (n=77)			
Man	40	51.9 %	
Woman	37	48.1 %	
Cataract Maturity (n=93)			
Grade 1	2	2.2 %	
Grade 2	31	33.3 %	
Grade 3	35	37.6 %	2.98 ± 0.97
Grade 4	17	18.3 %	
Grade 5	8	8.6 %	
Operational Techniques (n=93)			
Fakoemulsifikasi	93	100 %	

Based on table 1, it can be seen that the age proportion of research subjects in the early adulthood age group is 1.3%, late adulthood is 5.2%, early elderly is 9.11%, late elderly is 27.3%, and the elderly is 57.1%, the largest age group in this study . The mean age of the subjects in this study was 66.25 ± 10.34 years. The results of this study are in line with data on the prevalence of cataracts, the majority of which are senile cataracts, cataracts in people over 50 years of age. This is also in line with various studies which state that the prevalence of cataracts in individuals aged 65-74 years is 50% or the equivalent of half of all diagnosed cases of cataract and increases to 70% in individuals over 75 years. Many factors are thought to play a role in the occurrence of cataracts, such as the aging process, excessive exposure to ultraviolet light or other radiation, trauma, toxins, systemic diseases (eg diabetes and hypertension), smoking, and heredity. However, based on research, aging is the most common cause of cataracts. This happens because in old age, the main protein that makes up lens fibers, crystalline, which in normal conditions is transparent, undergoes a denaturation process so that the lens experiences cloudiness.

If we look at gender, more patients undergoing cataract surgery are male than female with the proportion of men being 51.6% and women being 48.4%. This is in line with research conducted by Fernanda, et al (2020) that in patients diagnosed with cataracts, it is

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more common in men, namely 11.7%, than in women, namely 8.2%. However, this research is not in line with the results of research conducted by Ade Utia Detty et al (2021) that the incidence of cataracts occurs more frequently in female patients, namely 58% compared to 42% in men, as well as research conducted by Lixia Lou et al. (2018) who explained that differences in cataract prevalence throughout the world based on gender tended to persist from 1990 to 2015 with the number of female patients always being greater than male. The explanation that supports the differences in gender characteristics in this study and most other studies is the difference in population criteria, where in the study the study population was cataract patients who had undergone cataract surgery. Susan Lewallen & Paul Courtright in their research explained that although 60% of cataract patients are women, 1.39 times more men undergo cataract surgery than women. This is in line with meta-analysis research by Farisa Shauma Fachir et al. that the 13 articles identified showed lower utilization of cataract surgery services in women than men (OR 0.76, 95% CI 0.60-0.98, p=0.03). This inequality is related to socio-cultural factors which believe that men have a higher status than women, so that men's health is sometimes given more priority, causing women to care less about their own health. In addition, women have less control over finances and women's many responsibilities in the household may limit their access to cataract surgery services.

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As for the maturity of the cataracts diagnosed in this study, most showed a maturity level of grade 3, namely 37.6%, then grades 2, 4, 5 respectively. In grade 3 cataract maturity, the nucleus shows moderate turbidity and appears yellow in color accompanied by grayish cortical turbidity, fundus reflexes are still good, with visual acuity between 6/30-3/60 or 20/100-20/400, where This vision is included in the group of moderate to severe visual impairment, so according to researchers, this is enough to encourage patients to seek help from health services. In addition, all subjects in this study were patients undergoing cataract surgery, where one of the considerations for carrying out surgery on cataract sufferers was based on how severe the clouding or maturity of the cataract was in the lens, so that it could cause difficulties in carrying out daily activities. If the patient's visual acuity is 6/24 or better, or pupil dilation is 2.5%, administration of phenylephrine or refractive glasses can provide improvements for the patient to be able to carry out daily activities. However, if the patient's visual acuity is worse than 6/24, consistent with cataract maturity

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grade 3 and above, or there are medical indications (such as: phacolytic glaucoma, phacomorphic glaucoma, and retinal detachment) accompanying the cataract, surgery can be performed.

All cataract operations in this study used the phacoemulsification surgical technique (100%). Phacoemulsification surgery is the act of crushing the eye lens using piezzo electric crystal vibrations into a softer form, so that it can be easily removed through a smaller wound (2-3 mm). Small incisions do not require stitches and will heal on their own. This allows patients to quickly return to daily activities. This is what makes this technique more widely used than other surgical techniques. A study conducted by Venkatesh (2010) explained that the phacoemulsification surgical technique had better UDVA (Uncorrected distance visual acuity) compared to the group that underwent the SICS procedure. Anak Agung et al. (2019) also stated that poor outcomes were more common in patients who underwent SICS surgery compared to phacoemulsification. However, the phacoemulsification technique carries a higher risk of posterior displacement of nuclear material through a posterior capsule tear.

Description of Preoperative Visual Acuity

Table 2. H Results of pre-cataract surgery visual acuity examination

Vision Pre Operation	Frequency	Percentage %
Normal Vision (6/6 - 6/12)	0	0
Mild Visual Impairment (< 6/12 - 6/18)	5	5.4
Moderate Visual Impairment (< 6/18 - 6/60)	34	36.6
Severe Visual Impairment (< 6/60 - 3/60)	16	17.2
Blind (<3/60)	38	40.9
Total	93	100

Based on table 2, the preoperative visual acuity results were found in the mild visual acuity group (6/12-6/18) at 5.4%, moderate visual acuity (6/18 - 6/60) at 36.6%, and severe visual acuity (6/6). /60 - 3/60) was 17.2%, and blind (<3/60) was 40.9%, the group with the highest visual acuity impairment in this study. This is in line with research by Ellen Konadu et al (2021), which shows a high presentation of pre-operative visual acuity, namely blindness, namely 71.4%. This could be because in this study all research subjects were cataract patients who underwent cataract surgery. Where the choice of therapy for cataracts is based on how severe the clouding of the lens causes difficulty in carrying out daily activities. If the patient's visual acuity is 6/24 or better, then administering phenylephrine or refractive glasses can provide improvements for the patient to be able to carry out daily activities. However, if the patient's visual acuity is worse than 6/24 then surgery is needed to provide an improvement effect for the patient.

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Postoperative visual acuity and refractive errors

Table 3. Results of visual acuity examination after cataract surgery

Vision	Day 1 post surgery		H+7 post operation		H+30 post operation	
	f	%	f	%	f	%
Normal Vision (6/6 - 6/12)	12	12.9	40	43	64	68.8
Mild Visual Impairment (< 6/12 - 6/18)	8	8.6	20	21.5	15	16.1
Moderate Visual Impairment (< 6/18 - 6/60)	31	28	28	30.1	12	12.9
Severe Visual Impairment (< 6/60 - 3/60)	12	12.9	2	2.2	1	1.1
Blind (<3/60)	30	32.3	3	3.2	1	1.1
Total	93	100	93	100	93	100

Data on visual acuity after cataract surgery shown in table 3, overall shows an improvement in visual acuity on the first post-operative day, where 12.9% of eyes showed normal vision, 8.6% had mild visual impairment, and 33.3% had moderate visual acuity. These three groups dominated more when compared to the two visual acuity groups that dominated the preoperative visual acuity examination, namely severe visual impairment decreased to 12.9% and blindness decreased to 32.3%. This data continues to improve in the control one week post operation with the normal vision group at 43%, mild vision impairment at 21.5% and moderate vision impairment at 30.1% as well as at the control one month post with the normal vision group at 68.8%, mild vision impairment 16.1 % and moderate visual impairment was 12.9%. From these data it can be seen that there is an increase in the quality of visual acuity for the better as the length of control time increases. This is because the surgical wound will begin to heal 1-2 weeks after surgery. Research conducted by Asmare et al stated that the average overall recovery time after cataract surgery was 23 weeks. Apart from that, in the same study it was also said that patient age, place of residence, DM, initial level of visual acuity, type of cataract and surgery were independent predictors of recovery time.

Table 4. Description of respondents' levels of stress, anxiety and depression

Refractive Disorders	Frequency	Percentage
Myopia	1	1.1
Hipermetropia	16	17.2
Astigmatisma Miopia Simplek (AMS)	9	9.7
Astigmatisma Miopia Kompositus (AMC)	0	0
Astigmatisma Hipermetropia Simplek (AHS)	10	10.8
Astigmatisma Hipermetropia Kompositus (AHC)	8	8.6
Astigmatisme Mikstus (AM)	9	9.7
No refractive errors were found	19	20.4
No correction of refractive errors was carried out	21	22.6
Total	93	100

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In table 4 it can be seen that of the 93 eyes that were research subjects, there were 53 eyes that showed refractive errors, the remaining 21 eyes were not assessed for refractive errors, this was because several patients had shown normal visual acuity and 19 eyes had no refractive errors. in assessing refractive status. Postoperative refractive errors still often occur due to various reasons such as imperfect pre-operative measurements, changes in lens position, and astigmatism due to surgery. Those who experienced refractive errors consisted of 16 (17.2%) hypermetropia eyes, 10 (10.8%) simplex hypermetropia astigmatism eyes, 9 (9.7%) simple myopia astigmatism eyes, 9 (9.7%) myopia astigmatism eyes, 8 (8.6%) eyes with myopic astigmatism composite hypermetropia, and 1 (1.1%) myopic eye. Another study by Ellen Konadu et al (2021) showed similar results, namely that the most common refractive error in patients after cataract surgery was astigmatism (35.5%). Astigmatism in patients after cataract surgery can be caused by the presence of incision scars or suture wounds on the cornea which is the refractive medium. Apart from that, this refractive error can also be caused by refractive media abnormalities that existed before surgery such as keratoconjunctivitis sicca, keratitis, ABMD (anterior basement membrane disease), and Salzman's nodular degeneration which can cause an irregular ocular surface and therefore can affect the accuracy of power measurements. cornea.

Description of Visual Acuity after Correction of Refractive Errors

Table 5. Results of visual acuity examination after postoperative correction of refractive errors.

Far vision was corrected post-operatively	Frequency	Percentage
Normal Vision (6/6 - 6/12)	48	90.6%
Mild Visual Impairment (< 6/12 - 6/18)	4	7.5 %
Moderate Visual Impairment (< 6/18 - 6/60)	1	1.9 %
Severe Visual Impairment (< 6/60 - 3/60)	0	0 %
Blind (<3/60)		
Total	54	100 %

Table 5 shows the results of visual acuity after correction of refractive errors after cataract surgery. Of the 53 eyes with refractive errors, there were 90.6% in the normal vision group, 7.5% with mild vision problems and 1.9% with moderate vision problems. No poor visual acuity or blindness was found. When compared with research conducted by Ellen Konadu et al (2021), the results of correction of refractive errors in post-cataract surgery patients showed visual acuity <3/60-LP (blind) as much as 11.1%, <6/60-3/60 (poor) as much as 22.2%, <6/18-6/60 (Borderline) as much as 33.3%, and 6/5-6/18 (good) as much as 33.3%, this study shows that the results of visual acuity after correction of refractive errors after cataract surgery are much better. Good. There are several factors that influence the results of visual acuity after cataract surgery, including poor access to the opportunity to undergo cataract surgery and reluctance to immediately undergo cataract surgery. Apart from that, the degree of maturity of the cataract at the time of surgery is also very influential, namely the higher the level of maturity, the greater the risk of cataract complications and difficulties in measuring the correct intraocular lens (IOL), thereby

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worsening the prognosis of post-surgical vision.

Accuracy of IOL Power Measurements

Table 6. IOL power, refractive target, and prediction error in biometric measurements

	Mean ± SD	Range
Strength IOL	18.77 ± 4.59	1.00 - 24.50
Refraction Target	-0.20 ± 0.18	-1.08 - +0.22
Prediction Error (PE)	-0,41 ± 0,61	-3,57 - +0,89

Installation of an intraocular lens (IOL) is a routine step in cataract surgery and the accuracy of its refractive power is very important in determining the refractive status after surgery. Table 6 shows that the average intraocular lens (IOL) power in the subjects of this study was 20.48 with a range of 1.00 - 24.50 D with a refractive target between -1.08 to +0.22 D and an average of -0.20 ± 0.18 D. The correct IOL refractive power requires Preoperative biometry measurements and accurate IOL power calculation formulas. Biometry is a measurement used to determine the strength of the eye's IOL by knowing the dimensions of the eye such as corneal strength, axial length of the eyeball, effective lens position (ELP), lens thickness, and central corneal thickness. The accuracy of this biometric measurement is very necessary considering that an error in measuring the axial length of the eyeball of 0.1 mm will cause a refractive error of around 0.23 diopters (D).

One indicator to determine the accuracy in calculating IOL strength is by looking at the prediction error (PE) value. Prediction error is used to describe the difference between target refraction and post-surgical refraction, with the formula PE = predicted refraction – actual post-surgical refraction. Actual post-surgical refraction is defined as the refraction status at the control one month after surgery which is then converted to spherical equivalent (SE) with the formula SE = spherical + 1⁄2 cylindrical. In this study the prediction error value ranged from -0.41 ± 0.61 D Most studies on adult eyes obtained a PE value of ±0.50 D or ±1.00 D. Li et al in their research on children's eyes defined a PE > ± 2.00 D as a significant refractive surprise. 26 The most important factor that contributes to the prediction value errors in IOL calculations are assumptions about the effective lens position, the IOL constant used, and the axial length of the eyeball.

CONCLUSIONS

Based on research conducted on post-cataract surgery patients at the JEC-Orbita Makassar Eye Hospital in 2022, several important findings can be concluded. Firstly, the characteristics of the patients show that the majority are elderly with more men than women, and the cataracts diagnosed tend to be grade 3 mature, with the Phacoemulsification surgical technique being the main method. Second, before surgery, almost half of the patients had poor visual acuity. However, post-operatively, there was significant improvement on the first day, one week, and one month after surgery, which continued with the control time. Third, the majority of postoperative refractive errors are hypermetropia, astigmatism and myopia, but with correction, the majority of patients show

normal vision. Fourth, analysis of IOL power, refractive target, and prediction error shows average values that are in accordance with general standards in adult eyes, with quite variable ranges of values. These findings provide a comprehensive picture of the results of cataract surgery and the course of post-operative vision recovery at the JEC-Orbita Makassar Eye Hospital.

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