

Aiming For Emmetropia after Cataract Surgery

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ABSTRACT:

BACKGROUND:

Emmetropia after cataract removal and posterior chamber intraocular lens implantation is vital for the achievement of a clear postoperative vision . Any significant deviation from this target leads to patient dissatisfaction.

OBJECTIVE:

The aim of this study is to evaluate the importance of various factors in causing deviation from post-cataract surgery emmetropia.

Design: prospective non comparative observational study.

METHODS:

114 eyes from 114 patients with uncomplicated cataract were enrolled for this study, biometry was done for the patients then they were operated on by phacoemulsification and foldable posterior chamber intraocular lens implantation .After one month from the surgery retinoscopy and manual refraction was done for all patients.

RESULTS:

Operated patients had a mean age of 61.4±5.6 years. Of the 114 eyes, 73 eyes (64.03%) were within 1 diopter (D) spherical equivalent (SE) of emmetropia. The number of eyes with postoperative astigmatism was 104 (91.22%); the mean absolute postoperative astigmatism amplitude was 1.346 D±0.421(SD). The mean absolute biometry prediction error was 1.007 D±0.246 (SD). The number of eyes with biometry error was 65 eyes (62.5%).

CONCLUSION:

Emmetropia is the goal in most cataract surgeries but only 64.03% of eyes were within 1.0 D (SE) of this target. Factors precluding emmetropia include postoperative astigmatism and biometry prediction errors.

KEYWORDS : emmetropia, phacoemulsification.

INTRODUCTION:

Cataract removal and posterior chamber intraocular lens implantation is a daily procedure, it is one of the most common surgeries done in ophthalmic clinics. The patient satisfaction with the result of the surgery depends to a large extent on the clarity of vision postoperatively. Postoperative emmetropia is a very important target for both surgeon and patient. Several studies in the developed world report high accuracy ⁽¹⁾ in the prediction of postoperative refraction, with 72% to 83% ⁽²⁻⁷⁾ of patients within 1.0 diopter of emmetropia as the target refraction. Risk factors for deviation from desired emmetropia include: older age ⁽²⁾, clear corneal (as opposed to limbal) incisions ⁽²⁾, and use of anterior chamber intraocular lens ⁽⁸⁾. Other identified causes include: incorrect corneal power measurement which is the most frequent reason for incorrect intraocular power implantation, followed by errors in axial

length measurement and insertion of a wrong intraocular lens ^(9,10). Identifying the factors responsible for deviation from postoperative emmetropia and trying to minimize them will improve the quality of postoperative vision and will save the surgeon and patients efforts.

PATIENTS AND METHODS:

A total of 114 patients with uncomplicated cataract are scheduled to undergo phacoemulsification and foldable posterior chamber implantation at AlKadhimya Teaching eye hospital were enrolled in a prospective non comparative observational study. This study was conducted between April 2010 and May 2012 at AlKadhimya Teaching eye hospital, Baghdad, Iraq. Exclusion criteria included any ocular pathology other than a cataract, intra operative complications, and inadequate follow up. Biometry for the calculation of the intraocular lens power , axial eye length , and keratometry was done using I O L Master. All surgeries were performed by a single surgeon under topical and peribulbar anesthesia (2% lidocaine) . All operated

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EMMETROPIA AFTER CATARACT SURGERY

eyes were dilated with topical tropicamide 1% and phenylphrine 10%. Post-operative visit at 1 day, 1 week, and 1 month. Post-operative subjective refraction and manual retinoscopy was done at 1 month.

RESULTS:

114 eyes were included in this study, we measured the postoperative refractive errors for each patient. For reasons of standardization, we adopted the spherical equivalence in the expression of the refractive errors (SE). we tried to classify the patients into groups so that we can identify the relevant data. In table 1; fig. 1 we divided the patients into three groups according to the amplitude of their deviation from postoperative emmetropia (which in our study is zero refractive errors); we can see that 73 eyes (64.03%) are within 1 D SE from emmetropia, 34 eyes (29.82%) are between 1.1 D SE and 2 D SE from emmetropia; and finally 7 eyes (6.14%) are more than 2 D SE from emmetropia. Table 2 shows the

demographic and clinical characteristics of patients as they are arranged according to their age. The important parameter in this table which is different among the groups is the mean absolute postoperative astigmatism amplitude which is 0.833 D in group 1 and increases to 3.125 D in group 7. The number of eyes with biometry prediction error was 0.00% in group 1, and increases to 100% in group 7. Table 3 classifies the eyes according to their axial length and correlates this with the biometry prediction errors. The percentage of eyes with biometry errors is 50% in group A (axial length = 20- 21 mm), while it is 87.5% in group G (axial length >26 mm). The mean absolute biometry error is 0.5 D in group A while it increases to 2.1 D in group G. Table 4 shows the final results of the study. We can notice that 104 eyes (91.22%) have postoperative astigmatism, and that 65 eyes (62.5%) have biometry prediction errors.

Table 1: Classifications of patients according to their postoperative refractive errors.

	Group A (0-±1 D SE*)	Group B (±1.1-±2D)	Group C (>±2D)	p value
No. of eyes	73 (64.03%)	34 (29.82%)	7 (6.14%)	
eyes with preoperative keratometric cylinder	68 (93.15%)	28 (82.35%)	7 (100%)	0.142
Mean preoperative keratometric cylinder	1.124±0.32 D	1.243±0.23 D	0.928±0.43 D	0.073
Eyes with postoperative astigmatism	64 (87.67%)	34 (100%)	6 (85.71%)	0.092
Mean absolute postoperative astigmatism	1.335±0.49 D	1.397±0.56 D	1.083±0.31 D	0.093
Eyes with biometry errors	28 (38.35%)	30 (88.23%)	7 (100%)	0.007
Mean absolute biometry errors	0.589±0.64 D	1.166±0.55 D	2±0.34 D	0.023

*spherical equivalent

D = Diopter

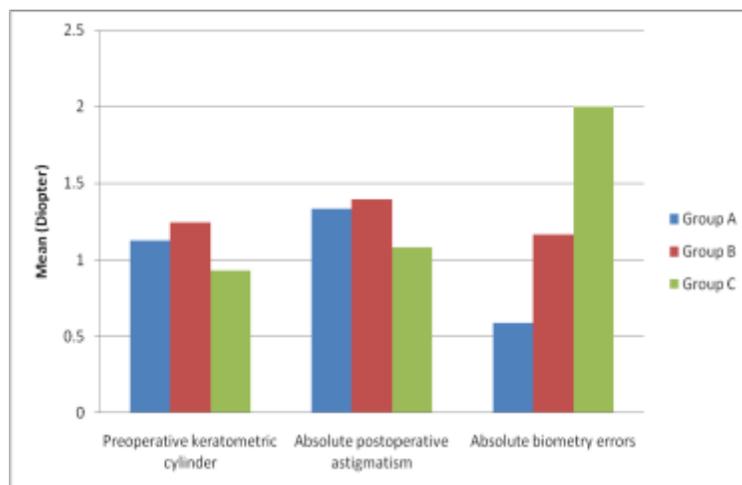


Fig.1 : Groups of patients according to their postoperative refractive errors.

EMMETROPIA AFTER CATARACT SURGERY

Table 2: Demographic and clinical characteristics of patients in relation to age.

	No. of eyes	Preoperative keratometry cylinder	Mean cylinder (Diopter)	Postoperative astigmatism	Mean astigmatism (Diopter)	Biometry error	Mean (Diopter)
Group I (20-30 year)	3	3 (100%)	1.66 +_0.21 D	3 (100%)	0.833+_0.33 D	0 (0%)	0+_0.11
Group II (31-40 year)	5	4 (80%)	2.375 +_0.23D	5 (100%)	1.15+_0.25 D	1 (20%)	1.0+_0.21
Group III (41-50 year)	12	10 (83.33%)	1.88+_0.42 D	10 (83.33%)	1.075+_0.22 D	6 (50%)	0.66+_0.23
Group IV (51-60 year)	36	33 (91.66%)	1.25 +_0.24D	31 (86.11%)	1.20+_0.51 D	24 (66.6%)	1.02+_0.41
Group V (61-70 year)	38	32 (84.21%)	1.12 +_0.26D	35 (92.1%)	1.435 +_0.12D	24 (63.15%)	1.01+_0.38
Group VI (71-80 year)	18	18 (100%)	0.956 +_0.52D	18 (100%)	1.51 +_0.31D	12 (66.6%)	1.15+_0.62
Group VII (81-90 year)	2	2 (100%)	1.8 +_0.34D	2 (100%)	3.125 +_0.43D	2 (100%)	0.75+_0.14
P value		0.548		0.564		0.093	

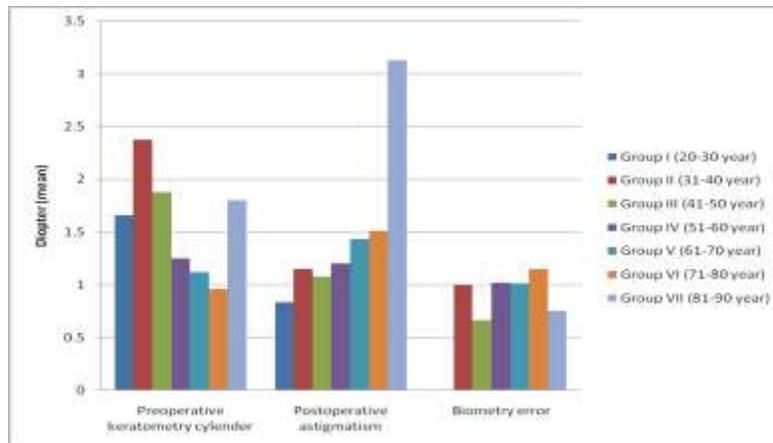


Fig. 2 : Classification of patients according to age

Table 3 : Relationship between axial length and biometry error.

Group	Axial length (mm)	No. of eyes	eye with biometry error	% of eye	Mean absolute biometry error (D)
A	20-21	2	1	50.00%	0.5+_0.13
B	21-22	13	7	53.85%	0.96+_0.21
C	22-23	38	21	55.26%	1.44+_0.62
D	23-24	37	26	70.27%	1.74+_0.54
E	24-25	11	8	72.73%	1.87+_0.63
F	25-26	5	4	80.00%	2+_0.47
G	>26	8	7	87.50%	2.1+_0.52

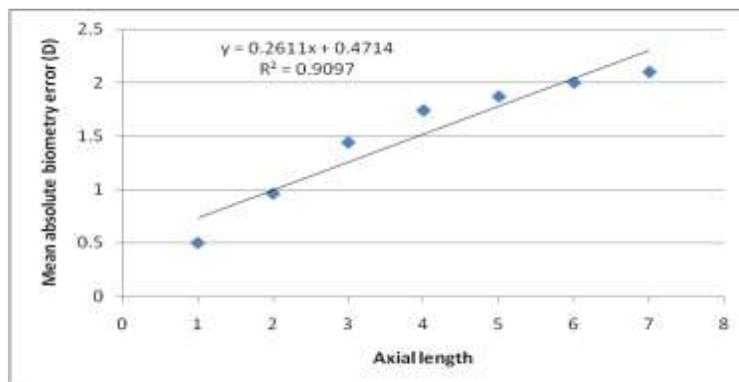


Fig. 3 : Relationship between axial length and biometry error.

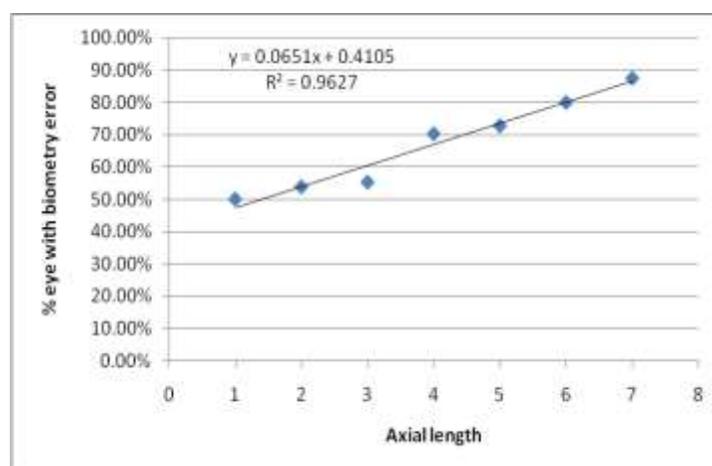


Fig. 4 : Relationship between axial length and the percentage of eyes with biometry errors

Table 4 : The overall result of the study specimen.

	No (%)	P value
Eyes with preoperative keratometric cylinder	109 (95.61%)	<0.001
Mean absolute keratometric cylinder	1.176 D	
Eyes with postoperative Astigmatism	104 (91.23%)	<0.001
Mean absolute postoperative Astigmatism	1.346 D	
Eyes with biometry errors	65 (57.02%)	0.133
Mean absolute biometry errors	1.007 D	

Total eye number=114

DISCUSSION:

In this study we notice that 73 eyes (64.03%) of patients are within 1 diopter spherical equivalent (SE) of the target refraction which is emmetropia. This value is slightly lower than the range of 72% -

83% of eyes falling within 1 diopter of the target refraction reported in studies from Europe and United states⁽²⁻⁷⁾. Yorstan and Foster report that the absolute value of the sphere was < 1.0 D in

53.5% of 71 eyes having cataract surgery in Kenya⁽¹¹⁾. Postoperative refractive errors, presumably resulting from inaccurate intraocular lens(IOL) selection and aphakia, has been reported as a leading risk factor for poor postoperative vision in several studies from rural Asia⁽¹²⁻¹⁸⁾. The median value of the IOLs implanted in this study is + 19.3 D. A median IOL power of +21.6 D has been reported in Vietnam (19) and +21.9 D in Kenya⁽¹¹⁾. In Taiwan⁽²⁰⁾, a lower value of + 20.0 D was found in 3068 cases. The lower power of implanted IOLs required in our study may reflect the increasing incidence of myopia in our patients. In our study we can notice that the postoperative absolute astigmatism amplitude increases steadily with the increase in the patients age, implicating that aging is an important factor. The percentage of biometry errors increases progressively as the age of the patients increase. Age is therefore an important factor, as this study shows, in causing a deviation from our target of postoperative emmetropia. The biometry error is also noticed to increase with the increment of the axial length of the eyes; the highest percentage of biometry error and the highest amplitude of biometry error occurs in eyes with high axial length. The overall percentage of eyes with postoperative astigmatism is 91.22% while the overall percentage of eyes with biometry errors is 62.5% which indicates that astigmatism has a bigger influence than biometry errors in the deviation from postoperative emmetropia.

CONCLUSION:

- 1-There are several factors preventing the patient from achieving clear vision postoperatively despite perfect surgery.
- 2-Biometry prediction errors, postoperative astigmatism, and preexisting keratometric cylinder are important factors preventing the achievement of postoperative emmetropia.
- 3-Correction of these factors can improve the quality of vision after cataract removal and intraocular lens implantation.

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