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Original Research Article

Assessing Correlation IOL Power and Refractive Error in Superior Phacoemulsification: A Pre- and Post-Operative Comparative Study

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Abstract

Aim: The aim of the present study was to assess the correlation between preoperative calculated IOL power and post-operative refractive error in superior phacoemulsification.

Methods: The study design was retrospective analysis which included 200 post-operative cataract patient data at department of Ophthalmology who underwent superior phacoemulsification surgery for the period of two years. The surgeries were done by four different surgeons of equal competence. A scan was done by US biometry and IOL master.

Results: 24% patients had 0 refractive error followed by 18% had >0.25- ≤0.5 refractive error. The mean post op spherical equivalent refractive error was -0.34 SD 0.76. A total of 39 percent had spherical equivalent less than or equal 0.25(0-0.25).57 percent patient had refractive error of less than or equal to 0.50. 70 percent patient had refractive error upto 0.75 D. t Test were applied and the pearson correlation value between the IOL power and post op spherical equivalent error was -0.097. Thus there was a no correlation between calculated pre op IOL power and post op spherical equivalent significant as p value came as 0.34. (r = -0.097, p= 0.34). Correlation between axial length and refractive error were negligible but not statistically significant in as in our study as p value was 0.34 which is more than 0.05. (r =0.096, p = 0.34).

Conclusion: Our study with its result showed that there was no statistically significant correlation between IOL power and post op refractive error and so there is no way that we can guess about the residual refractive error on the basis of IOL power.

Keywords: IOL, refractive error, superior phacoemulsification.

Introduction

An accurate biometry and appropriate intraocular lens power (IOLp) formula selection in cataract surgery is very important for postoperative patient satisfaction. [1] Measurement, IOL calculation formula, IOL insertion, and lens constant's errors are the main sources of postoperative refractive errors. [2-5] Cataracts are the main cause of blindness worldwide and accounted for 51% of all cases of blindness reported by the World Health Organization in 2010. [6] Moreover, the percentage exceeds 60% in some Chinese elderly populations. [7] With the rapid development of cataract surgery techniques, the expectations of both patients and ophthalmologists have substantially risen. Currently, phacoemulsification and IOL implantation have moved from vision recovery to refractive surgery as an essential treatment for cataracts.

Bilateral sequential cataract surgery has been widely applied in the pursuit of better visual quality. In early 2008, Norrby S [8] concluded that the preoperative estimation of the postoperative IOL position, postoperative refraction determination, and preoperative axial length (AL) measurement were the critical factors for RE (35, 27, and 17%, respectively). Refractive myopia shift or hyperopia shift after cataract surgery is mainly caused by prediction error in postoperative anterior chamber depth (ACD), i.e., a shift in myopia, or the effective lens position (ELP). [9,10] Refraction

will shift more than 0.32 diopters (D) if the postoperative ACD varies by 1mm. [11] It is therefore imperative to use an IOL calculation method for the second eye not only due to the patients' need for clear vision but also because some problems related to poor visual recovery caused by the RE of the first eye can be prevented by calculating the IOL power using better test parameters.

Intraocular lens (IOL) calculation accuracy of the conventional methods usually involving several factors to achieve postoperative emmetropia includes the surgeon factor, axial length (AL), biometry measurements, and additional measurements in some formulas, e.g., anterior chamber depth (ACD, measured from corneal endothelium to lens) and lens thickness (LT). However, the real-time intraoperative aberrometry (IA) during cataract surgery, Optiwave Refractive Analysis (ORA) (Alcon, Fort Worth, TX, USA) system estimating IOL power based puraely on refractive algorithm without AL and keratometry measurements during cataract surgery in an aphakic state, could transcend this uncertainty. [12-14] Thereby, the refractive outcome may be improved, especially in complicated cases, such as those after refractive surgery. [15,16]

The aim of the present study was to assess the correlation between preoperative calculated IOL power and post-operative refractive error in superior phacoemulsification.

Materials and Methods

The study design was retrospective analysis which included 200 post-operative cataract patient data at department of Ophthalmology, Nalanda Medical College and Hospital, Patna, Bihar, India who underwent superior phacoemulsification surgery for the period of two years. The surgeries were done by four different surgeon of equal competence. A scan was done by US biometry and IOL master. Automated k1, k2 readings were used The machine used for surgery was Alcon's Laureate , Foldable lenses from different brands were used in the surgery.

Inclusion Criteria

1. Cases in which superior phaco were done.
2. Senile cataract.
3. Only those cases were selected in which final best corrected vision was 6/6 with or without correction.
4. Patients whose 1-month post op data was available.

Exclusion Criteria

1. All complicated cataracts.
2. Patients with ocular pathology.
3. Patient with intraoperative and post op complication.
4. Cases with history of any previous ocular surgery.

Preop evaluation was done and formula used was SRK/T., HOFFER Q AND HAIGIS.

Post op subjective refraction was done at 4 weeks and the subjective refractive error was converted into spherical equivalent. For every IOL used spherical equivalent was calculated at 4 weeks. Post op treatment included E/d prednisolone acetate 1 drop 6 times taper weekly and E/d Moxifloxacin 1 drop qid for 6 weeks.

Results

Table 1: Distribution of patients according to refractive error

Refractive error	N%
0	48 (24)
>0- ≤0.25	30 (15)
>0.25- ≤0.5	36 (18)
>0.5-≤0.75	26 (13)
>0.75- ≤ 1	28 (14)
>1	32 (16)

24% patients had 0 refractive error followed by 18% had >0.25- ≤0.5 refractive error.

Table 2: Other details

Mean	21.36	-0.34226
Variance	24.12919192	0.551330389
Observations	200	200
Pearson Correlation	-0.096984250	
Hypothesized meanDifference	0	
df	96	
T Stat	42.1073813	
P(T<=t) One - tail	2.48908E-64	
t Critical one - tail	1.660391156	
P(T=t)Two - tail	4.97817E-64	
t Critical two - tail	1.984216952	

The mean post op spherical equivalent refractive error was -0.34 SD 0.76. A total of 39 percent had spherical equivalent less than or equal 0.25(0-.25).57 percent patient had refractive error of less than or equal to 0.50. 70 percent patient had refractive error upto 0.75 D. t Test were applied and the pearson correlation value between the IOL power and post op spherical equivalent error was -.097. Thus there was a no correlation between calculated pre op IOL power and post op spherical equivalent significant as p value came as 0.34.(r = -0.097, p= 0.34). Correlation between axial length and refractive error were negligible but not statistically significant in as in our study as p value was 0.34 which is more than 0.05. (r =0.096, p = 0.34).

Discussion

Cataract surgery underwent huge evolution over the years. Being one of the most common elective surgical procedures, cataract surgeries witnessed huge improvement with personalized biometric measurements. Cataract surgery in the present era is considered more of refractive procedure and patients expect to have a glass free life. A correct IOL power can minimize the residual refractive error after surgery. Axial length and keratometry finding contribute to the IOL power. One of the most stabilised correlation is between axial length and residual refractive error. [17] While an error of 1mm measurement error causes 2.8 D calculation error of post refractive error and error of 1 D keratometry causes approximately error of approximate 1 D calculation error. [18] Due to these reason ophthalmologist are extra careful in hyperopic eyes biometry and eyes with unusual findings. Formula related errors can cause errors of calculation. While srk/t is good for medium range eyes, hoffer q and haigis are good for extreme values. [19]

24% patients had 0 refractive error followed by 18% had >0.25- ≤0.5 refractive error. The mean post op spherical equivalent refractive error was -0.34 SD 0.76. A total of 39 percent had spherical equivalent less than or equal 0.25(0-.25).57 percent patient had refractive error of less than or equal to 0.50. 70 percent patient had refractive error upto 0.75 D. t Test were applied and the pearson correlation value between the IOL power and post op spherical equivalent error was -.097. Thus there was a no correlation between calculated pre op IOL power and post op spherical equivalent significant as p value came as 0.34.(r = -0.097, p= 0.34). Correlation between axial length and refractive error were negligible but not statistically significant in as in our study as p value was 0.34 which is more than 0.05. (r =0.096, p = 0.34). Fraser et al [20] proposed that contrast sensitivity and stereopsis rather than vision are the key factors that affect the improvement of vision-related quality of life after cataract surgery. Jivrajka et al [21] also reported that the substitution of half of the error from the first eyes into the calculation of IOL power of the respective second eyes can improve their outcomes. However, the difference between binocular diopters should be carefully considered to avoid visual discomfort caused by monovision or anisometropia. [22]

Our study result were similar with Aristodemou et al [23] in which refractive error of less than 1 D were present in 80 percent of cases. Advantage of this study was a large sample size and values were taken from many surgical centres. Hoffer et al [24] study showed 94.5 percent patient were within range of 1.00D. Olsen et al [25] reported that 87 percent patient refractive error was within 1D limit. This study was similar to our study because it used different IOL type of different company and different formula was used. The IOL used were from range of 18.92 -37.45. Correa et al [26] studied retrospectively in 81 patient with axial length of 22-25mm and presented residual refractive error 40.7% within 0.50 D,35.7% within 0.51 to 1.25 D, 9.8% within 1.26 to 2D. Lagrasa et al [27] reported 24% patients within 0.25 D, 55 percent within 0.5 D and 91 percent within 1D. In Hubaille et al [28] study different types of foldable lenses of different brands were use as in our study. This study was also retrospective. They found the error were within 0.75 D in 78% cases and within 1 D in 88% cases. Rajan et al [29] conducted study a range of axial length 23.4 1.2. Mean absolute error was .62 .40. 87 percent patient was within 1.00 D.

Conclusion

Our study with its result showed that there was no statistically significant correlation between IOL power and post op refractive error and so there is no way that we can guess about the residual refractive error on the basis of IOL power.

References

1. Roh YR, Lee SM, Han YK, Kim MK, Wee WR, Lee JH. Intraocular lens power calculation using IOLMaster and various formulas in short eyes. Korean Journal of Ophthalmology. 2011 Jun 1;25(3):151-5.
2. Skuta GL, Cantor LB, Weiss JS. Basic and Clinical Science Course: Section 3 Clinical Optics. American Association of Ophthalmo - logy. 2011.
3. Duke Eye Center [home page on the Internet]. Durham. Refractive cataract surgery: meeting patient expectations [updated September, 2015].
4. Olsen T. Sources of error in intraocular lens power calculation. Journal of Cataract & Refractive Surgery. 1992 Mar 1;18(2):125-9.
5. Lee AC, Qazi MA, Pepose JS. Biometry and intraocular lens power calculation. Current

opinion in ophthalmology. 2008 Jan 1;19(1) :13-7.
6. Pascolini D, Mariotti SP. Global estimates of visual impairment: 2010. Br J Ophthalmol. 2012;96(5):614–8.
7. Hu JY, Yan L, Chen YD, Du XH, Li TT, Liu DA, Xu DH, Huang YM, Wu Q. Population-based survey of prevalence, causes, and risk factors for blindness and visual impairment in an aging Chinese metropolitan population. Int J Ophthalmol. 2017;10(1):140–7.
8. Norrby S. Sources of error in intraocular lens power calculation. J Cataract Refract Surg. 2008;34(3):368–76.
9. Fayette RM, Cakiner-Egilmez T. What factors affect intraocular Lens power calculation? Insight. 2015;40(4):15–8.
10. Yang F, Hou X, Wu H, Bao Y. Analysis of refractive status after cataract surgery in age-related cataract patients with shallow anterior chamber. Zhonghua Yan Ke Za Zhi. 2014; 50 (2):84–8.
11. Olsen T. Calculation of intraocular lens power: a review. Acta Ophthalmol Scand. 2007;85(5) :472–85.
12. Hemmati HD, Gologorsky D, Pineda R. Intraoperative wavefront aberrometry in cataract surgery. InSeminars in ophthalmology. Taylor & Francis. 2012 Nov 1; 27:5-6:100-106.
13. Ianchulev T, Salz J, Hoffer K, Albini T, Hsu H, LaBree L. Intraoperative optical refractive biometry for intraocular lens power estimation without axial length and keratometry measurements. Journal of Cataract & Refractive Surgery. 2005 Aug 1;31(8):1530-6.
14. Zhang Z, Thomas LW, Leu SY, Carter S, Garg S. Refractive outcomes of intraoperative wavefront aberrometry versus optical biometry alone for intraocular lens power calculation. Indian journal of ophthalmology. 2017 Sep; 65(9):813.
15. Yesilirmak N, Palioura S, Culbertson W, Yoo SH, Donaldson K. Intraoperative wavefront aberrometry for toric intraocular lens placement in eyes with a history of refractive surgery. Journal of Refractive Surgery. 2016 Jan 1; 32(1):69-70.
16. Fram NR, Masket S, Wang L. Comparison of intraoperative aberrometry, OCT-based IOL formula, Haigis-L, and Masket formulae for IOL power calculation after laser vision correction. Ophthalmology. 2015 Jun 1; 122(6):1096-101.
17. Hashemi H, Khabazkhoob M, Emamian MH, Shariati M, Miraftab M, Yekta A, et al. Association between Refractive Errors and Ocular Biometry in Iranian Adults. J Ophthalmic Vis Res. 2015;10(3):214– 20.
18. Astbury N, Ramamurthy B. How to avoid mistakes in biometry. Community Eye Health. 2006;19(60):70–1.
19. Sanders DR, Retzlaff JA, Kraff MC, Gimbel HV, Raanan MG. Comparison of the SRK/T formula and other theoretical and regression formulas. J Cataract Refract Surg. 1990; 16(3): 341–6.
20. Fraser ML, Meuleners LB, Lee AH, Ng JQ, Morlet N. Vision, quality of life and depressive symptoms after first eye cataract surgery. Psychogeriatrics. 2013; 13(4):237–43.
21. Jivrajka RV, Shammas MC, Shammas HJ. Improving the second-eye refractive error in patients undergoing bilateral sequential cataract surgery. Ophthalmology. 2012; 119(6):1097–101.
22. Rutstein RP, Fullard RJ, Wilson JA, Gordon A. Aniseikonia induced by cataract surgery and its effect on binocular vision. Optom Vis Sci. 2015;92(2):201–7.
23. Aristodemou P, Cartwright NEK, Sparrow JM, Johnston RL. Formula choice: Hoffer Q, Holladay 1, or SRK/T and refractive outcomes in 8108 eyes after cataract surgery with biometry by partial coherence interferometry. J Cataract Refract Surg. 2011;37(1):63–71.
24. Hoffer KJ. The Hoffer Q formula: a comparison of theoretic and regression formulas. J Cataract Refract Surg. 1993;19(6): 700–12.
25. Olsen T, Gimbel H. Phacoemulsification, capsulorhexis, and intraocular lens power prediction accuracy. J Cataract Refract Surg. 1993;19(6):695–9.
26. Corrêa ZMS, Kronbauer FL, Goldhardt R, Marcon IM, Bakowicz F. Precisão ecobiométrica da fórmula SRK/T na facoemulsificação. Arq Bras Oftalmol. 2001; 64(3):233–7.
27. Lagrasta JM, Allemann N, Scapucin L, Moeller CT, Ohkawara LE, Melo LA, et al. Clinical results in phacoemulsification using the SRK/T formula. Arq Bras Oftalmol. 2009; 72(2):189–93.
28. Hubaille C, Groot VD, Tassignon MJ. Comparison of preoperative target ametropia and postoperative refraction for three types of lenses and intra-ocular differences (one pliable acrylic, one pliable PMMA- copolymer and one non-pliable PMMA). Bull Soc Belge Ophtalmol. 2001;280:35–42.
29. Rajan MS, Keilhorn I, Bell JA. Partial coherence laser interferometry vs conventional ultrasound biometry in intraocular lens power calculations. Eye (Lond). 2002;16(5):552–6.