Original Research Article

A study on keratometry, axial length and IOL power among patients undergoing cataract surgery

Abhishek Kulkarni[1], Pranesh Kulkarni[2*]

[1]Assistant Professor, [2]Professor and Head Department of Ophthalmology, KBN Institute of Medical sciences, Kalaburgi, Karnataka, INDIA.
Email: dr.p.kulkarni15@gmail.com

Abstract

For ocular examination there are three diagnostic aids namely, A-scan B-scan and M-scan with these techniques, several different systems for ultrasonically evaluating patients have been evolved. Independently either only A-scan or only B-scan do provide reliable diagnostic information but a combination of both diagnostic methods gives more information. Patients undergoing cataract surgery with IO.L implantation were selected from the inpatient wards of Government General Hospital and Teaching and General Hospital. The patients were selected regardless of age and sex total number of patients examined were 50. Out of the 50 patients, sex wise distribution is 24 males (48%) and 26 were females (52%). Age wise distribution showed that maximum number of patients tend to be in 50-60 age group. The number of cases tend to increase with age upto 60 years where the number of cases operated are maximum.
Keywords: Keratometry, Axial Length and IOL.

***Address for Correspondence:**
Dr. Pranesh Kulkarni, Professor and Head, Department of Ophthalmology, KBN Institute of Medical sciences, Kalaburgi, Karnataka, INDIA.
Email: dr.p.kulkarni15@gmail.com
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INTRODUCTION

Ultrasound is an acoustic wave that consists of an oscillation of particles within a media. By definition, ultrasound waves have frequencies greater than 20 KHz (i.e, 20,000 Oscillations/sec) which renders them inaudible by humans. Mundt and Hughes first used ultrasound in ophthalmology in 1956. They used amplitude mode (A-scan) to evaluate a intra ocular tumour showing that ultrasound had potential as diagnostic tool in ophthalmology. The first clinical use of A-scan in ocular diagnostic problems was presented by Oksala in 1957. The use of ultrasound for ocular measurement and determination of velocity constant for ocular tissue was described by Jansen. In 1958, Baum and Green wood described the clinical use of B-scan for ophthalmic diagnosis and measurement. Coleman, with Weininger, in 1967 described the use of M-scan in ophthalmic application.[1,2] B-scan diagnosis was first developed by Baum and Greendwood, who made valuable observation on B-scan evaluation of eye and orbits. Further pioneering work with immersion B-scan was carried by purnell followed by Coleman *et al.* In 1970 Coleman and associates developed first commercially available immersion B-scan instrument. A short time Later, Bronson introduced contact B-scan machine for ophthalmology. This instrument was portable and allowed placement of the probe on closed eye lids. Other areas of B-scan ophthalmic investigations have been explored by Hughes of Australia which by using common wealth acoustic laboratory equipment has shown excellent result of ocular structures. M-scan diagnosis, first developed by Coleman and Weininger has been used to study physiological changes during accommodation and magnetic properties of foreign bodies. It is also been used for examining vascular and respiratory pulsations in ocular and orbital tissues. For ocular examination there

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are three diagnostic aids namely, A-scan B-scan and M-scan with these techniques, several different systems for ultrasonically evaluating patients have been evolved. Independently either only A-scan or only B-scan do provide reliable diagnostic information but a combination of both diagnostic methods gives more information.[3]

B-scan provides a two dimensional display which presents a more complete picture than is available with A-scan. The third dimension of amplitude levels can be displayed on certain types of B- scan, but in less sophisticated equipments it is more easily obtained by observing the A-scan monitor simultaneously with B-scan. M-scan is beneficial in demonstrating consistent or reproducible pulsation like respiratory or vascular pulsations of certain tissues, or the magnetic properties of foreign bodies. Surgery of the lens has been practised for at least several thousand years. Earliest authentic records come from ancient Hindu medicine long before Christian era. An operation of couching of reclination was employed in India in around 3000 BC.[4] Extraction of Cataratous lens was first proposed by Daviel in the middle of 18th century. Von Graefe in 1865 made the section in upper half of eye and has advocated iridectomy. Intra capsular cataract extraction was first done by Sharp in 1753. Contemporaneously with sharp, the more direct technique of pushing the lens out after impaling its posterior pole with a needle thrust through sclera was adopted by Richter (1773) Beer (1799) and Von Constalt (1871). Zonular destruction as an aid to intra capsular extraction was first done mechanically by Di-lula (1866) who slipped a curved probe around the lens. J. Barraquer dissolved Zonules with solution of alpha- chymotsypsin.[5] Sutures as a safety measure to close the section after surgery were introduced by Henry W Williams (1867) of New England who first inserted a single corneo-scleral suture. In early 20th Century there was a steady shift from extra capsular cataract technique to the intra capsular technique due to non-availability of micro surgical techniques. Harold Schie (1960) Charles Kalman (1966) and Binkhorst are responsible for resurgence of the extra capsular technique which forms an important step in the implantation of Intra ocular lens. An intra ocularlenticulus produces a smaller image than a contact lens facilitating binocular vision in uniocularaphakia. The pioneer in the development of this technique is H. Ridley (1951-57) who implanted an acrylic lenticulus with appropriate optical correction within the lens capsule. The Ridley lens can be described as first generation intra ocular lenses.[6] Anterior chamber implants technique was introduced by Strampelli (1953-55) Strampelli's original implant was steadied by a rigid frame resting in the angle of anterior chamber, an elastic frame similarly placed was used by Dannheim (1957-62), while its flanges may be made to penetrate into the limbus (Strampelli 1954). An alternative is fixation onto the Iris or (in extra capsular extraction) onto the iris and lens capsule (Binkhorst (1957-67) modifications to above technique were introduced by Barraquer 1956, Choycee 1958-66, Epstein 1959, Boberg-Ans 1961. Anterior chamber implants are considered second generation intra ocular lenses.[7,8] Binkhorst was the first to recognise that placing the loops of the intra ocular lens in the capsular bag produced good results. He proposed "Irido capsular lens", these capsulo fixed lens can be considered fourth generation lenses.

METHODOLOGY

Patients undergoing cataract surgery with IO.L implantation were selected from the in patient wards of Government General Hospital and Teaching and General Hospital. The patients were selected regardless of age and sex total number of patients examined were 50.

History was taken regarding Complaints: Like diminition of vision - Duration, onset, history of using glasses in the past for distant and near vision.

Preliminary examination with torch and loupe was done. Slit lamp examination was performed. Visual acuity - un aidedwith best correctionwith pin hole were noted.

Fundus examination when possible was done. Status of other eye was noted. Keratometry was done and readings noted in millimetres. A scan biometry with Ultrasound biometer model 820 was performed. Patient was explained about procedure and then 4% xylocaine is instilled in the eye. A scan biometry was performed with probe, with patient looking straight ahead and probe was aligned with the optical axis. Axial length (AL), lens thickness (L) and Anterior chamber depth (ACD) were obtained using the auto mode. Required data was entered for I.O.L power calculation like AL, 'A' constant for the I.O.L, 'K' readings (both horizontal and vertical) in diopters.

RESULTS

Table 1: Age Wise distribution

Age groups	No. of Cases	Percentage
1-l0 years	0	0%
11-20years	1	2%
21-30years	2	4%
31-40years	5	10%
41-50years	6	12%
51-60years	19	38%
61-70years	11	22%
71-80years	2	04%
81-90years	3	06%
91 and above	1	02%
Total	**50**	**100%%**

Table-1 shows age wise distribution of cases of the 50 cases studied. Maximum were in the age group 51-60 years, 19 cases (38%).

Table 2: Sex wise distribution

Sex	No. of Cases	Percentage
Male	24	48%
Female	26	52%

In the above table the sex wise distribution and incidence is shown. Out of the 50 cases studied, 24 were males (48%) and 26 were females (52%).

Table 3: Range of Parameters

Parameter	Rang	
	Minimum	Maximum
Keratometry	41.56	47.86
Axial length	21.00	24.62
1.O.L Power	17.00	25.00

This table shows the three parameters used in this study i.e., Keratometry, Axial length and I.O.L Powers. Keratometry readings fell in the range of 41.56 D and 47.861). Axial length varied from a minimum of 21.00 and a maximum of 24.62 mm whereas 1.O.L power used were between 17.001) and 25D.

Table 4: Average Reading of Parameters

Parameter	Average
Keratometry	44.62D
Axial length	22.91mm
1.O.L Power	21.28D

DISCUSSION

In the present study 50 patients who have undergone extra capsular cataract extraction with posterior chamber I.O.L implantation were studied and reviewed periodically from first through sixth post operative weeks to observe the deviation of spherical equivalent if any, from expected deviation. Out of the 50 patients, sex wise distribution is 24 males (48%) and 26 were females (52%). Age wise distribution showed that maximum number of patients tend to be in 51-60 age group. The number of cases tend to increase with age upto 60 years where the number of cases operated are maximum. Keratometry readings varied from 41.56 D to 47,86D, axial length from 21 mm to 24.62 mm, 1.O.L power used ranged from +17. D to +25 D. These readings are within normal standards. Of the 50 patients studied the average Keratometry readings obtained was 44.62 D, axial length average 22.9 1mm and average I.O.L power used 21.28 D. These averages are also within normal standards. The minimum power of I.O.L used was +17 D and maximum power of I.O.L used + 25D.

The result of this study show that the deviation from estimated post operative refraction is

42% cases within ± 1SD.
68% cases within ± 2SD.
87% cases within ± 3SD.
100% cases within ± 4SD.

Showing that when standard deviation increased from X ± I SD to X ± 4SD all 50 cases (100%) were within the range. Further the results of this study tally closely with similar studies conducted by Limdi and Sheth. (April 1991), Thomas Oslen (Jan. 1987) and Josel Menenzo (1984). The maximum error obtained in the present study was +2.50 DS and - 1.50 DS. Errors in primary implant power prediction attributable to routine axial length and Keratometry measurements inaccuracy are significantly greater than errors resulting from 1.O.L power prediction formula. In these days of availability of micro surgical instruments it is our aim to give the patient the maximum possible post operative visual acuity with the use of instruments like Keratometer and A scan. The importance of accurate I.O.L implant power calculation has increased with the development improved astigmatism control, multifocal technology and increasing patient' s and surgeon expectation. Accurate I.O.L implant power calculation requires a disciplined multistep process obtained by establishing a system that carefully addresses each step of the process. Precise biometric measurements of preoperative axial length and corneal curvature are the corner stones of this system.[9,10]

CONCLUSION

Assessing the results of the present study, A scan proved to be quite reliable and fairly accurate instrument in the prediction of power of posterior chamber I.O.L fairly accurately thus helping in our endeavour to improve the quality of vision of the patient and therefore quality of life. These results can be further refined by using immersion instead of applanation for measurement of axial length and by calculating the personal A constant for each surgeon and lens style.

REFERENCES

1. Intraocular lens power calculation in eyes with short axial length, Moschos MM, Chatziralli IP, Koutsandrea C. Indian J Ophthalmol 2014;62:692-4.
2. The Necessity of axial length a scan in intraocular lens power estimation, DM Tamblyn, Australin Journal of Opthtalmology. (198 lL9. DD. 293-296
3. Value of posterior keratometry in the assessment of surgically induced astigmatic change in cataract surgery 2016 ActaOphthalmologicaScandinavica Foundation. Published by John Wiley and Sons Ltd doi: 10.1111/aos.13003
4. Determination of the power of a convex-plano intraocular lens in situ from the dioptric keratometer reading of its front surface: extension table for the Javal-Schi0tz ophthalmometer C D Binkhorst, M C Colenbrander, and

L H Loones, British Journal of Ophthalmology, 1987, 71, 473-476

5. Measurement of axia length in th calculation of intraocular lens power, P Sunder Raj A. Watson Eye (1998) 12,227-229
6. Effect of axial length and keratometry measurement error on intraocular lens implant power prediction formulas in pediatric patients Maya Eibschitz-Tsimhoni, MD,a Omer Tsimhoni,J AAPOS Volume 12 Number 2 / April 2008
7. Intraocular lens power calculation using the IOLMaster and various formulas in eyes with long axial length Jia-Kang Wang, MD, Chao-Yu Hu J Cataract Refract Surg 2008; 34:262–267
8. Influence of the effective lens position, as predicted by axial length and keratometry, on the near add power of multifocal intraocular lenses, GiacomoSavini, MD, Kenneth J. Hoffer, J Cataract Refract Surg 2016
9. Interocular Axial Length and Corneal Powe Differences as Predictors of Postoperative Refractive Outcomes after Cataract Surgery, VinayKansal, BHSc, Ophthalmology 2018;-:1e10 ª 2018 by the American Academy of Ophthalmology.
10. Axial length measurement and its relation to intraocular lens power Calculations H. John F. Shammas, AM Intra-ocular Implant Soc J-vol. 8, Fall 1982.

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