# Distribution of ocular Biometric parameters cataract Surgery candidate

**BACHELOR OF OPTOMETRY**

(Established under Galgotias University Uttar Pradesh Act No. 14 of 2011)

**SUBMITTED BY**
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**(8th Semester)**

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**School of Medical and Allied Sciences**
**Galgotias University,Greater Noida**

# DISSERTATION

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**Topic:** Distribution of ocular Biometric parameters cataract Surgery candidate.

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GALGOTIAS UNIVERSITY

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School of Medical and Allied Sciences

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# CERTIFICATE

This is to certify that the Dissertation titled **"Distribution of ocular Biometric parameters cataract Surgery candidate"** submitted by "**GYANPAL GAURAV**" is in partial fulfillment of requirement of 8th Sem in BACHELOR OF OPTOMETRY DEGREE a record of Bonafide work done under my/our guidance. The contents of this Dissertation, in full or in parts, have neither been taken from any other source nor have been submitted to any other Institute or University for award of any degree or diploma and the same is certified.

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**(Organization stamp)**

**Objective of the Dissertation is satisfactory /unsatisfactory with remarks**

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## CERTIFICATE FROM THE INSTITUTE

This is to certify that **GYANPAL GAURAV** bearing Registration no. **18SMAS1030042** Has completed objective formulation of thesis titled, **"Distribution of ocular Biometric parameters cataract Surgery candidate"** under my guidance and supervision. To the best of my knowledge, the present work is the result of her original investigation and study. No part of the thesis has ever been submitted for any other degree at any University.

The Dissertation is satisfactory for submission and the partial fulfillment of the conditions for the award of BACHELOR OF OPTOMETRY.

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| **Nagula Dinesh Kumar** | **Vikas Srivasthava** |
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# DECLARATION

I, **GYANPAL GAURAV**, student of **BACHELOR OF OPTOMETRY** under the Department of **SCHOOL OF MEDICAL OF ALLIED SCIENCES** in Galgotias University, Greater Noida, hereby declare that all the information furnished in this dissertation is based on my own intensive research and is genuine. This Dissertation, which has been submitted for the award of my degree, does not, to the best of my knowledge, contain any part of research work, either of this university or any other university without proper citation.

**Enrollment No.** 1821030124

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**Abstract**

**Aim:-** Distribution of ocular biometric parameters among cataract surgery candidates.

**Backgrounds** Ocular biometry is essential in many clinical and research application for example Al (Axial length is essential in intraocular lens power calculation prior to cataract and refractive surgeries making diagnosis of staphyloma etc).

**Material and Method** is this is a tabulation observation study one hundred fifty one patient with bilateral cataract seducle for cataract surgery during 6 month study period. Medical record in Age and gander calculated.

**Ocular Biometric** data Including Al axial length the ACD anterior chamber depth (LT)lens thickness and (VCD) virtuous chamber depth value were means for both eye before cataract operation either eye Using optical biometer Ophthalmic A/B Ultrasound system All metric data were observed by the same expressed Ophthalmic teachnian to avoid interobserver error.



**Keyword**

Optical biometry.

Immersion biometry.

IOL power calculation. IOL power calculation formula. Axial length. Anterior chamber depth. Average keratometry. Corneal power.

## ACKNOWLEDGEMENT

It gives me a great pleasure in presenting this project as a success of 6 month study SHARP SIGHT GROUP OF EYE HOSPITAL, DELHI No venture of this kind is possible with a single hand. I would like to take the privilege to thank the Management of SHARP SIGHT GROUP OF EYE HOSPITAL for giving me the opportunity to do my training there. This project is an acknowledgement to the intensity drive and technical competences of many individuals who have guided me for its completion let me express my simple gratitude to them. I have a great pleasure in offering gratitude to MISS AADITI CHAUHAN of my hospital for his never-ending assistance.

I am also thankful to all those departments where I have been posted without their help and guidance it would have not been possible to learn necessary things and training would not have been successful.

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BACHELOR OF OPTOMETRY 4 TH YEAR
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# INTRODUCTION

## Definition

The crystalline lens is a transparent structure .Its transparency may be disturbed Due to degenerative process leading to opacification of lens fibres. Development of an opacity in the lens is known as cataract.

## According to WHO

Inflammation and some other diseases. Cataract is clouding of the lens of the eye which prevent clear vision. Although most cases of cataract are related to the aging process .occasionally children can be born with the condition, or a cataract may develop after eye injuries.

## Cataract surgery

Cataract surgery, also called lens replacement surgery, is the removal of the natural lens of the eye [also called "crystalline lens] that has developed an pacification which is referred to as a cataract, and its replacement with an intraocular lens.

## Ocular biometry

The first step to achieve satisfactory postoperative refractive outcome is accurate ocular Biometry. Biometry enables the measurement of the various dimensions of the eye, including Axial length (AL), anterior chamber depth (ACD), lens thickness (LT) or central corneal thickness (CCT). These values, together with the keratometry are essential for the IOL power calculation.

Biometry is two type optical biometry and non- optical biometry.

• The optical biometry under the optical method.

• Non optical biometry under the immersion method.

## Optical biometry

The introduction of optical biometry has steadily replaced ultrasound methods and is now Considered the clinical standard for ocular biometry. The results are comparable to those achieved by immersion ultrasound biometry, but this new method is fast, easy to reproduce by different examiners, non-invasive and non-contact Repeatability and reproducibility of measurements obtained using this Technique are high and the results are less dependent on operators' Skills. However, it is difficult to obtain a measurement in the presence of a dense cataract or other opacities such as corneal scar and vitreous Hemorrhages. Optical biometry measures the distance from the corneal Surface to the retinal pigment epithelium (RPE). It may be associated with overestimation of measurements of about 0.15–0.5 mm.12 Optical Biometry can also be successfully performed in pseudophakic or silicone Oil-filled eyes. Furthermore, in high myopic eyes, due to the presence of posterior staphyloma, it may give better results than conventional Ultrasound techniques for measuring the AL.

**Ultrasonic biometry [ Immersion Biometry]**

For many years, the only way to measure the AL of the eye was with ultrasound biometry. This Technique measures the distance from the surface of the corneal apex to the Internal limiting Membrane (ILM). Good alignment along the ocular axis is important and that requires patient Cooperation (which can be difficult in children or patients with mental disorders).

In cases where A probe has direct contact with the cornea, there is a risk of a corneal damage or infection. Therefore, a topical anesthetic and proper disinfection of the probe are required. Occurring Inter-individual differences are highly dependent on the pressure exerted on the eye by the ultrasound probe.

High pressure results in corneal indentation and shortening of the AL.


Immersion ultrasound minimizes the indentation of the cornea as it uses a saline-filled shell between the probe and the eye. Clinical studies have shown that immersion biometry is more accurate and more reliable than ultrasound biometry performed in contact mode.

limitation of ultrasound Biometry is low image resolution, as a consequence of using a long, low-resolution wavelength (10 MHz) to measure small dimensions. In addition, differences in retinal thickness near the fovea or the presence of other macular pathologies contribute to inconsistent measurements.

Ultrasound biometry is an invasive procedure that requires direct contact with the cornea and use of anesthetics.

1: - Probe tip echo from tip of probe now moved away from the cornea and has become visible.

2: - Cornea double peaked echo will show both the anterior and posterior surface.

3: - Anterior lens.

4: - Posterior lens capsule.

5: - Retina this also need to have sharp 90 degree take off from the baseline.

6: - Sclera

7: - Orbit fat

**Mathematics and measurements IOL formulae for calculation**

Most of the modern-day formula based upon here the IOL power is chosen as the variable calculation on the basis.

**P= A-0.9K-2.5AL**

- P= power of the IOL
- A= a constant
- K=average keratometry value
- Al= axial length in mm.

**Underline principal and parameters.**

- Corneal power K
- Axial length AL
- ACD
- Lens thickness patchy.

**Biometry is two type optical biometry and non- optical biometry.**

- The optical biometry under the optical method.
- Non optical biometry under the immersion method.

## Literature review

Age and sex are important factors influencing ocular Biometrics. It may be important to consider them and Potential biometric refinements made, in the calculation of IOL power for cataract surgeries as well as in corneal Refractive surgeries.

The latest biometry technologies and modern IOL power calculation Formulas have significantly improved refractive outcomes after cataract Surgery. Well-calibrated devices, using optical rather than ultrasound Biometry, optimized IOL constants and properly selected last-generation IOL power calculation formulas that fit to a particular patient can provide Excellent refractive outcomes. These data represent normative biometric values for the Portuguese population.

The greatest Predictor of ocular biometrics was gender. There was no significant correlation between Age and AL, ACD, or Km. These results may be relevant in the evaluation of refractive error and in the calculation of intraocular lens power. Our outcomes suggest that OB-820 presents significant difference with IOL-Master in AL measurements, suggesting that these biometry devices should not have been used interchangeably, since it is well known that AL is an integral component of modern formulas that estimate the dioptric power of the IOL. However, larger cohorts of ataractic patients and stratification according to their cataract level are necessary to confirm our results and contribute to the body of knowledge on the important issue of ocular biometry. Female cataract patients have smaller axial length and anterior chamber depth but higher corneal curvature when compared to their male counterparts.

**Aim of study**

Distribution of ocular biometric parameters among cataract surgery candidates.

**Objective**

1.To asses ocular biometry parameter

2. To correlate parameter with associated factor.

**Need of study**

Ocular biometry parameters, axial length, anterior chamber depth, lens thickness, vitreous chamber depth is necessary for cataract surgery and its visual outcome peachick intraocular lens is a supplementary lens is inserted into the eye after cataract surgery. The deigns of IOL and post operative visual outcome depends on patients correct ocular biometric parameters.

With the increase in life expectancy there has been a progressive increase in the volume of cataract surgery baring the mined vital rule ocular biometric in diagnostic eye cere, we intend study. The ocular biometric parameters and associated factor in cataract surgery patients.

**Methodology**

Study site sharp sight eye center new Delhi

Type of study cross sectional study

Study design clinical study

Study population Delhi

## Martial and method

This is a cross-sectional observational study. One hundred fifty-one Patients with bilateral cataract were scheduled for cataract Surgery Cataract patients with history of ocular trauma or surgery, Complicated cataract in either eye, secondary causes of Cataract such as diabetes mellitus, uveitis were excluded from the study. Gender was collected. Ocular biometric data including AL, ACD, LT, for both eyes before Cataract operation for either eye, using an optical biometer Ophthalmic ultrasound. ALL metric data were observed by the same ophthalmic Technician to avoid interobserver error.

### Study criteria

### 1. Inclusion criteria

• Patient between ages 40 to 80 year

• patient with senile cataract

### 2. Exclusion criteria

• Patient with congenital development traumatic and secondary cataract.

• patient undergo any refractive corneal retinal surgery

• patient with ocular trauma • patient with metabolic disorder

• Sample size: 151

## RESULT ANALYISIS

There were 151 participants. The age range was 40 to 80 Years, with a mean age of 57.73 ± 14.87 years [95% Confidence interval (CI), 54.70–59.90]. The mean age of Males and females was 57.31 and 57.16 years, Respectively, and their difference was not statistically Significant (P = 0.910). Of the 151 participants, 77 (51.0%) were males and 74 (49.0%) were females. The Male-to-female ratio is approximately 1:1 [Table 1].

*Table 1: age and sex distribution of study participants*

| | | Sex | | Total | P value |
|---|---|---|---|---|---|
| | | Male | Female | | |
| Mean age ± SD (years) | 57.73 ± 14.87 | 57.31 ± 15.84 | 58.16 ± 13.88 | | 0.910 |
| Age group (years) | <30 | 4 | 2 | 6 | |
| | 30–49 | 14 | 16 | 30 | |
| | 50–69 | 41 | 38 | 79 | |
| | 70–89 | 18 | 18 | 36 | |
| Total | | 77 | 74 | 151 | |

The median ACD was decreasing with increasing age up to ≥50 years. The median LT increased with increasing age. The IQR was Similar across the age groups. Those <30 years were below.The 75th percentile the median VCD decreased with increasing age. The IQR Was similar across the age groups the median AL was higher in males than females (24.00 vs23.00). The IQR was 23.50 to 24.00mm in males, and for Females was 22.50 to 24.00mm [Figure 5]. The median ACD was a little higher in males than females (3.30 vs. 3.10 mm). The IQR was 2.90 to 3.50mm in males, and for females was 2.80 to 3.40mm [Figure 6]. The median LT was same in males than females.

*Table 2: Correlation between OD and OS*

| Variable | Correlation coefficient (r) | P value |
|---|---|---|
| AL | 0.370 | <0.001* |
| ACD | 0.447 | <0.001* |
| LT | 0.297 | <0.001* |
| VCD | 0.334 | <0.001* |

*Table 3: Distribution of axial length (AL), anterior chamber depth (ACD), lens thickness (LT), and vitreous chamber depth (VCD) as mean, and 95% confidence intervals of mean (CI) by age*

| Age (years) | N | AL (mm)Mean (95% CI) | ACD (mm)Mean (95% CI) | LT (mm)Mean (95% CI) | VCD (mm)Mean (95% CI) |
|---|---|---|---|---|---|
| <30 | 6 | 24.41 (23.36–25.95) | 3.50 (3.12–3.91) | 3.85 (3.52–4.29) | 17.06 (16.37–17.92) |
| 30–49 | 30 | 23.47 (23.17–23.75) | 3.31 (3.12–3.54) | 4.25 (4.10–4.39) | 15.90 (15.64–16.23) |
| 50–69 | 79 | 23.44 (23.27–23.62) | 3.20 (3.05–3.28) | 4.26 (4.20–4.35) | 16.02 (15.78–16.23) |
| 70–89 | 36 | 23.54 (23.26–23.85) | 3.22 (3.12–3.42) | 4.21 (4.10–4.33) | 16.11 (15.85–16.42) |
| P value | | 0.446 | 0.076 | 0.119 | 0.094 |
| Total | 151 | 23.51 (23.33–23.64) | 3.22 (3.12–3.30) | 4.23 (4.17–4.29) | 16.06 (15.89–16.20) |

*Table 4: Distribution of axial length (AL), anterior chamber depth (ACD), lens thickness (LT), and vitreous chamber depth (VCD) as mean and 95% confidence intervals of mean (CI) by sex*

| | N | AL (mm)Mean (95% CI) | ACD (mm)Mean (95% CI) | LT (mm)Mean (95% CI) | VCD (mm)Mean (95% CI) |
|---|---|---|---|---|---|
| Male | 7 | 23.84 (23.64– | 3.28 (3.18–3.39) | 4.21 (4.12–4.30) | 16.35 (16.18– |
| | 7 | 24.03) | | | 16.55) |
| Female | 7 | 23.16 (23.02– | 3.15 (3.07– | 4.25 (4.17–4.32) | 15.76 (15.58– |
| P value | 4 | 23.39) | 3.31) | 0.496 | 16.00) |
| Total | | <0.001* | 0.110 | 4.23 (4.17–4.29) | <0.001* |
| | 15 | 23.51 | 3.22 (3.16– | | 16.06 |
| | 1 | (23.37–23.66) | 3.31) | | (15.94–16.21) |

Shows the distribution of AL, ACD, LT, and VCD as Mean, and 95% cis of mean by age group. In the studied Sample, mean AL was 23.51 mm (95% CI, 23.33–23.64 Sample, mean AL was 23.51 mm (95% CI, 23.33–23.64), Mean ACD was 3.22mm (95% CI, 3.12–3.30), mean LT was 4.23mm (95% CI, 4.17–4.29), and the mean VCD was 16.06mm (95% CI, 15.89–16.20). AL was longer among Those ages less than 30 years, ACD was decreasing with increasing age, and the mean LT was higher for age 30 to 69.

## Discussion

With a difference in mean values of about 0.04mm. The Mean differences observed are relevant, as it may suggest an ethnic and racial variation in AL. As a 1-mm error in AL results in a residual postoperative refractive error of About 3.00D in a 23.5-mm eye, about 2.00 D in a 30.00- Mm eye, and about 4.00 D in a 20.00-mm eye.

Table 2: Correlation between OD and OS Variable Correlation coefficient (r) P value.
AL 0.370 <0.001*
ACD 0.447 <0.001*
LT 0.297 <0.001*
VCD 0.334 <0.001*

Table 3: Distribution of axial length (AL), anterior chamber depth (ACD), lens thickness (LT), and vitreous chamber depth (VCD) as mean, and 95% confidence intervals of mean (CI) by age Age (years) AL (mm)Mean (95% CI) ACD (mm)Mean (95% CI) LT (mm)Mean (95% CI) VCD (mm)Mean (95% CI).

Table 4: Distribution of axial length (AL), anterior chamber depth (ACD), lens thickness (LT), and vitreous chamber depth (VCD) as mean and 95% confidence intervals of mean (CI) by sex.

AL (mm)Mean (95% CI) ACD (mm)Mean (95% CI) LT (mm)Mean (95% CI) VCD (mm)Mean (95% CI)

**Male** 77 23.84 (23.64–24.03) 3.28 (3.18–3.39) 4.21 (4.12–4.30) 16.35 (16.18–16.55).

**Female** 74 23.16 (23.02–23.39) 3.15 (3.07–3.31) 4.25 (4.17–4.32) 15.76 (15.58–16.00)

P value <0.001* 0.110 0.496 <0.001*

Total 151 23.51 (23.37–23.66) 3.22 (3.16–3.31) 4.23 (4.17–4.29) 16.06 (15.94–16.2).

## Conclusion

Age and sex are important factors influencing ocular biometrics. It may be important to consider them and potential biometric refinements made, in the calculation of IOL power for cataract surgeries as well as in corneal refractive surgeries. The latest biometry technologies and modern IOL power calculation Formulas have significantly improved refractive outcomes after cataract Surgery. Well-calibrated devices, using optical rather than ultrasound Biometry, optimized IOL constants and properly selected last-generation IOL power calculation formulas that fit to a particular patient can provide Excellent refractive outcome.

**References**

1. Dr.A k Khurana comprehensive ophthalmology 6th edition page no.172

2. Dr.A k Khurana comprehensive ophthalmology 6th edition page no.183

3. Lawrence David; Fedorowicz, Zbys;van zuuren Esther J [2015-11-02] Cochrane eyes and Vision group.

4. About cataract community ZEISS group https://cataract-community.zeiss.com/opticalbiometry - explained

5. About cataract community ZEISS group https:// cataract-community.zeiss.com/optical biometry – explained

6. George R, Rupauliha P, Sripriya AV, et al., Comparison of Endothelial cell loss and surgically induced astigmatism Following conventional extra capsular cataract surgery, manual Small-incision surgery and phacoemulsification, Ophthalmic Epidemiol,

7. Zheng L, Merriam JC, Zeider M, Astigmatism and visual recovery After ‘large incision’ extra capsular cataract surgery and ‘small’ Incisions for phacoemulsification, Trans Am Ophthalmol Soc, 1997;95:387–410.

8. Javitt J, Steiner R, Cataract extraction with multifocal Intraocular lens

implantation: a multinational clinical trial Evaluating clinical, functional and quality-of-life outcomes, Ophthalmology, 2000;107:2040–8.

9. Basic and Clinical Science Course, Section 3: Clinical Optics. (2011-2012 ed.) American Academy of Ophthalmology. Pp. 211–223.

10. Ossining KC, Standardized ichnography: basic principles, clinical Applications and results. Into Ophthalmol Clan, 1979;19:127–210.

11. Schelling J, Kaman J, Comparison of contact and immersion Technique for axial length measurement and implant power Calculation, J Cataract Refract Surge, 1989;15:425–8.

12. Shame's HJF, A comparison of immersion and contact Techniques for axial length measurements, J Am Intraocular Implant Soc, 1984;10:444–7.

13. Olsen T, Nielsen PJ, Immersion versus contact technique in the Measurement of axial length by ultrasound, Acta Ophthalmol, 1989;67:101–2.

14. Lee AC, Qazi MA, Pepose JS, Biometry and intraocular lens Power calculation, Curr Opin Ophthalmol, 2008;19:13–7.

15. Frings A, Dulz S, Skevas C, et al., Postoperative refractive error After phacovitrectomy for epiretinal membrane with and

16. Without macular oedema, Graefes Arch Clan Exp Ophthalmol, Rabsilber T,

Jepsen C, Auffarth G, Holzer M. Intraocular lens power calculation: Clinical comparison of two ocular biometry devices. J Cataract Refract Surge.

17. Saka N, Ohno-Matsui K, Shimada N, Sueyoshi S, Nagaoka N, Hayashi W, et al. Long-term changes in axial length in adult eyes with pathologic myopia. Am J Ophthalmol 2010; 150:562-8.

18. Ruiz-Moreno J, Montero J, de la Vega C, Alio J, Zapater P. Retinal detachment in myopic eyes after phakic intraocular lens implantation. J Cataract Refract Surge 2006; 22:247-52.

19. Saw S, Chua W, Gazzard G, Goh D, Tan DTH, Stone RA. Eye growth changes in myopic children in Singapore. Br J Ophthalmol 2005; 89:1489–94.

20. Sutton D. Text book of radiology and imaging, ultra sound of the eye & orbit. 7th ed. Vol. 2. Edinburgh: Churchill Livingstone; 2003. P. 1551.

21. Lee K, Klein BEK, Klein R, Quandt Z, Wong T. Age stature and education associations with ocular dimensions in an older white population. Arch Ophthalmol 2009; 127:88-93.

22. Nover A, Grote W. On the determination of the length of the axis of the human eye with ultrasound in the living person. Albrecht Von Graefes Arch Klin Exp Ophthalmol 1965; 168:405-1.

# Curriculum Viate

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**Education Qualification**

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|---|---|---|
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| 2018 | 12th | N.E.B |
| 2022 | U.G | Galgotias University |

**Skills:**

- Good learner
- Positive Behavior
- MS Word
- Excel

**Hobbies:**

- Playing
- Travelling
- Reading
- Gaming

**Strength:**
- Good communication skill
- Ability to work in team
- Organizational skill