



## *Keratometry, Biometry and Intraocular Lens power of Guinean Patients Undergoing Cataract Surgery at the Eye Center Clinic in Conakry*

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### Abstract

*This study aims to propose a standardized IOL Power that could be extrapolated to the general population who do not benefit from kerato-biometry and IOL power calculation during surgery. This observational study was over two years and included 216 eyes of 216 patients, regardless of sex, aged over 39, all of whom had undergone age-related cataract surgery. An association was sought between socio-epidemiological variables and mean values for keratometry, axial length, anterior chamber depth and intraocular implant power. Statistical analysis was carried out using Epi Info 7.2 Software. Correlations between the ocular biometric parameters and the mean age were analysed with the Person test for a p-value < 0.05. The study revealed that means values of Keratometry was 44.7±2.2 D, Anterior chamber dept 3.2± 0.5mm ; axial length 23.4±1.0 mm and IOL Power 21.0±2.0 D. A significant association was found between gender and mean values for keratometry, biometry and IOL power (p=0.001). These values could serve as a reference for many centers in the country and during surgery campaigns for the Guinean population.*

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### Introduction

Cataracts are the most blinding eye disease of the elderly. The only currently known effective treatment is surgery. Several techniques have been developed, and even the most recent and sophisticated, femto-second laser-assisted surgery, is not sufficient on its

own to restore good visual condition [1]. For the best possible post-operative functional result, a series of well-conducted preliminary examinations is required to find the intraocular lens (IOL) perfectly suited to the eye to be operated on. These are keratometry and biometry. The aim of these measurements is to use

mathematical calculations to find the IOL power best suited to each eye, so as to restore or at least improve the patient's vision as much as possible. A recently published study showed that dry eyes can affect keratometry measurements [2]. In another study, the authors also found that IOL power could be affected by the keratometry method used, the type of ultrasound used and its velocity, even after error-free biometry [3]. Despite these recent publications, a Burkinabe study had already found, that an average IOL power of 21.5 diopters was perfectly well adequate in 60% of cataract operated eyes [4]. The present study was motivated on the one hand by the non-availability of biometry devices in some ophthalmology centers in Guinea and on the other hand by the constant stock-outs of IOLs of certain powers. The aim of the present study was to propose an intraocular implant power that could be extrapolated to the guinean population, based on the mean values obtained from the keratometry and biometry of patients undergoing consultation at the EYE Center ophthalmology clinic in Conakry.

## Patients and Methods

### Patients

The study was observational, running from January 2023 to December 2024. It included 216 eyes of 216 patients, regardless of sex, aged over 39, all of whom underwent age-related cataract surgery at the EYE Center Ophthalmology Clinic. The study excluded other forms of cataract and patients in whom keratometry was practically impossible (keratoconus, ectatic cornea, scar cornea or dystrophy, nystagmus, and Parkinson's patients). Recruitment was carried out in accordance with the recommendations of the Helsinki Declaration of Ethics for Studies Involving Human Subjects [5].

## Methods

### Recruitment Method

Patient recruitment was exhaustive, carried out by an ophthalmologist in a consultation room targeting populations aged forty and over, complaining of reduced distance visual acuity. A full slit-lamp ophthalmological examination was carried out, and patients diagnosed with operable cataracts were selected. Once informed consent had been obtained and signed by the patient or his legal representative, the indication for surgery was established. Keratometric

and biometric parameters were measured in a dedicated room. The variables studied were sociodemographic (age, gender, education status), biometric (keratometry, axial length and depth of the anterior chamber) and intraocular implant power. Educational status was applied to measure its influence on biometry.

### Keratometry

The study used a Korean-built Matronix® QK30+ automatic keratorefractometer. The measurement method involved the patient sitting in front of the machine, with his chin resting on the chin rest. The test patterns targeted the central 3 mm of the patient's cornea, and three consecutive measurements were taken automatically, with the average used for this study. Thus, keratometry (K) expressed in dioptres (D) was the average of the flattest corneal radius of curvature (K1) and the most cambered radius of curvature (K2). Keratometry was considered small for values < 42 D, normal between 42-46D and large for values  $\geq 47$  D [6]. Keratometry was taken by the same operator.

### Axial Length and Anterior Chamber Depth

Axial length (AL) and anterior chamber depth (ACD), expressed in millimeters (mm), were measured using a Quantel Medical® Compact Touch ultrasound scanner in A mode. Patients were positioned supine and asked to stare at a point on the ceiling perpendicular to their gaze. A drop of Proparacaine hydrochloride 0.5% (Aurocaïn®) was instilled into the eye before positioning the ultrasound probe. The probe was placed in the center of the cornea, and the laser beam activated by the foot pedal to take the measurements automatically. Ten measurements were successively and automatically taken by the machine, and the averages were used for this study. Axial length was said to be small for values < 22 mm, normal between 22-25 mm and large  $\geq 26$  mm [7]. The ACD was said to be narrow for values < 2.4 mm, normal between 2.4 - 3.9 mm and very deep for values  $\geq 4.0$  mm [8]. The ACD was measured before surgery at the same time as axial length. The different measurements were taken by the same experienced ophthalmologist.

### Calculating the Power of the Intraocular Implant (P)

The method of calculation was that once the values of the axial length obtained from biometry in A mode, the values of K1 and K2 obtained from keratometry and the constant A of the implant supplied by the

manufacturer (A=118.4), they were introduced into the Quantel® biometer which automatically proceeded to calculate the power P of the implant. The theoretical formula SRK- T, which states that  $P = A - 2.5 AL - 0.9 K$  [9], the most commonly used formula today, in our context, was immediately selected. The average power was calculated by summing the individual powers of each patient over the total number of the study population.

### Statistical Methods

Statistical analysis was carried out using Epi Info 7.2 software and the data exported to Excel using R v4.2 Software. The uncorrected Chi square test was used to compare frequencies and proportions. Mean values of keratometry, axial length, and intraocular implant power were compared between age, gender and education status using the Kruskal-Wallis rank sum test. Correlations between ocular biometric parameters and age means were analysed with the Person test for a p-value < 0.05.

## Results

### Descriptive Study

A total of 216 patients were included in the present study out of 571 cataract surgeries. This large number of excluded patients corresponded perfectly well to our selection criteria and made it possible to minimise bias, which was a fundamental limitation of this study. Its advantage lies in the fact that, despite its small size, it has nevertheless made it possible to find average values for biometric parameters that will be sufficiently usable for services within the country. The table 1 summarises the descriptive parameters of the study population.

**Table 1 :** Socio-Epidemiological Parameters, Keratometry, Axial Length, Anterior Chamber Depth and Intraocular Implant Power.

|                           | n   | %    | Mean ± SD | Extremes    |
|---------------------------|-----|------|-----------|-------------|
| <b>Sex</b>                |     |      |           |             |
| Male                      | 107 | 49.5 | -         | -           |
| Female                    | 109 | 50.5 |           |             |
| <b>Instruction status</b> |     |      |           |             |
| Instructed                | 39  | 18.1 |           |             |
| Uninstructed              | 177 | 81.9 |           |             |
| <b>Age (years)</b>        |     |      |           |             |
| 48-57                     | 43  | 19.9 |           |             |
| 58-67                     | 75  | 34.7 | 66.5±9.9  | 48 – 94     |
| 68-75                     | 64  | 29.6 |           |             |
| 76-84                     | 22  | 10.2 |           |             |
| ≥ 85                      | 12  | 5.6  |           |             |
| <b>K (Dioptre)</b>        |     |      |           |             |
| < 42                      | 45  | 20.8 | 44.7±2.2  | 36.9 – 54.2 |
| 42-46                     | 167 | 77.3 |           |             |
| ≥ 47                      | 4   | 1.9  |           |             |
| <b>ACD (mm)</b>           |     |      |           |             |
| < 2.4                     | 17  | 7.9  | 3.2± 0.5  | 2.0 – 4.3   |
| 2.4-3.9                   | 172 | 79.6 |           |             |
| ≥ 4,0                     | 27  | 12.5 |           |             |
| <b>AL (mm)</b>            |     |      |           |             |
| < 22                      | 3   | 1,4  | 23.4±1.0  | 21.4 – 30.3 |

|              |     |      |          |            |
|--------------|-----|------|----------|------------|
| 22-25        | 211 | 97.7 |          |            |
| ≥ 26         | 2   | 0.9  |          |            |
| <b>P (D)</b> |     |      |          |            |
| ≤ 19         | 90  | 41.7 | 21.0±2.0 | 9.5 – 25.0 |
| 20-22        | 99  | 45.8 |          |            |
| ≥ 23         | 27  | 12.5 |          |            |

*K* : keratometry

*ACD* : Anterior chamber depth

*AL* : Axial length

*P* : intraocular implant power

In this survey, 64.3% of patients were aged between 58 and 75, with a significant proportion of 20% younger, aged under 58. There were as many women as men, with a sex ratio of 1. The education ratio was 0.2, with 82% of the population uneducated. Keratometry was normal in 77.3% with a mean of 44.7±2.2 dioptres ; extremes of 37 and 54 dioptres. However, it was very small in 21% of patients and very large in almost 2%. Mean anterior chamber depth was 3.2±0.5 mm, with extremes of 2.0 and 4.3 mm. It was normal in almost 80% of the population and deeper in 12.5%. Mean axial length was 23.4±1.0 mm, with extremes of 21.4 and 30.3 mm. The eyes were normal overall in almost 98% of the population, and very small in 3 patients. For intraocular implant power, the average found in this series was 21.0±2.0 D with extremes of 9.5-25.0 D. Nearly 46% of the population had an intraocular implant with a power between 20-22 D ; 42% had a power ≤ 19 D and only 12.5% had a higher power.

### Analytical Study

The table 2 summarizes the correlation of mean values for keratometry, biometry and IOL power with socio-epidemiological parameters

**Table 2** : Correlation of Mean Values for Keratometry, Biometry and IOL Power with Age, Gender and Educational Status.

|                           | <b>K (D)</b> | <b>AL (mm)</b> | <b>ACD (mm)</b> | <b>P (D)</b> | <b>P-value</b> |
|---------------------------|--------------|----------------|-----------------|--------------|----------------|
| <b>Mean age (year)</b>    |              |                |                 |              |                |
| < 67                      | 43.8         | 23.3           | 3.3             | 21           | ≥ 0.292        |
| ≥ 67                      | 43.4         | 23.5           | 3.3             | 20.5         |                |
| <b>Sex</b>                |              |                |                 |              |                |
| Male                      | 43.2         | 23.6           | 3.3             | 21.5         | < 0.001        |
| Female                    | 44.1         | 23.1           | 3.2             | 20.5         |                |
| <b>Instruction status</b> |              |                |                 |              |                |
| Instructed                | 43.3         | 23.6           | 3.2             | 20.5         | ≥ 0.100        |
| Uninstructed              | 43.8         | 23.3           | 3.3             | 21           |                |

### Discussion

Cataract, known to be the leading cause of curable blindness worldwide [10], has as its only effective treatment exclusively surgery [1]. The present study was to investigate the keratometry and biometry of cataract surgery patients at the EYE Center clinic in Conakry in order to propose a standardized IOL extrapolable to the Guinean population not benefiting from calculation of their implant power during the surgical procedure. It is safe to say that this is the very first study of its kind in the Republic of Guinea. A more inclusive population size would have been desirable, but as this is a preliminary study, its scientific character cannot be compromised. In the literature, although cataracts used to be a pathology of older subjects [11],

current publications show that they are becoming younger and younger, given the average age in the series. In their study of the epidemiological and clinical aspects of cataract in the administrative region of Kankan in Guinea in 2022, Sovogui MD et al. [12] found a population with an average age of  $65.2 \pm 39.4$  years. In 2022, Mba AT et al. [13] revealed that the mean age was  $68.6 \pm 12.1$ . For Yoon JH et al [14] in 2023 their population had a mean age of  $69.50 \pm 9.46$  years. In Portugal Ferreira TB et al. [7] had a population of  $69.0 \pm 10$  years. No static sex difference was found in any of the published series. Cataracts therefore affect as many women as men. With regard to corneal refractive power, the number of patients with normal keratometry (between 42-46 D) in this series was highly comparable to those in Gabon [13]. Table 3 clearly shows the biometric parameters of similar studies.

**Table 3 :** Mean Values of Biometric Parameters from Recent Published Studies.

| Parameters  | Ferreira TB et al. 2017 (Portugal) | Huang Q et al. 2018 (China) | Mba AT et al. 2019 (Gabon) | Yoon JH et al. 2023 (Korea) |
|-------------|------------------------------------|-----------------------------|----------------------------|-----------------------------|
| Keratometry | Automated                          | Automated                   | Automated                  | Automated                   |
| Biometry    | OLCR                               | I                           | US                         | I                           |
| Population  | 13 012                             | 6933                        | 1 196                      | 203                         |
| K (D)       | $43.9 \pm 1.7$                     | $44.2 \pm 1.6$              | $43.4 \pm 1.5$             | $44.1 \pm 1.3$              |
| AL (mm)     | $23.9 \pm 1.6$                     | $24.3 \pm 2.4$              | $23.3 \pm 0.9$             | $24.1 \pm 1.5$              |
| ACD (mm)    | $3.3 \pm 0.4$                      | $3.1 \pm 0.5$               | -                          | $3.1 \pm 0.4$               |
| P (D)       | -                                  | -                           | $21.6 \pm 2.2$             | $20.2 \pm 3.5$              |

*OLCR : Optical low-coherence reflectometry*

*US : Ultrasound*

*I : Interferometry.*

Overall, the mean values for this series are perfectly consistent with all these publications. However, as far as keratometry is concerned, they are much closer to Asian values than to African and Caucasian ones. The biometric values, meanwhile, are identical to those for Gabon and Portugal. Generally speaking, the Guinean population is therefore within the normal limits of keratometry and biometry worldwide. There is no significant static difference between the mean intraocular lens power calculated in this series and that of Mba Aki et al. [13] in Gabon or Yoon JH et al. [14] in Korea. This would mean that an IOL with a power of between 19 and 23 dioptres could be well suited to the Guinean patient, enabling him to have useful vision post-operatively without prior calculation, of course, if the surgical procedure had been simple. However, it would have been desirable for each centre to have its own equipment for the patients they treat. In this study, the lack of correlation found between keratometry and biometry with age ( $p \geq 0.292$ ) was contrary to the series by Mba AT et al. [13], who found a significant correlation between these variables. They indicated that axial length tended to decrease with age, although the cross-sectional nature of the study did not allow them to explain why. The difference between the studies may lie in the methods used. In this series, the influence of sex was highly significant on all the biometric parameters. The cornea were more curved in women and the eyes longer in men. For Mba AT et al. [13], mean keratometry was significantly higher in men and axial length greater in women. The superiority of axial length in men compared to women found in this series had already been reported by numerous studies [7,11,15] in the order of 0.5 to 0.9 mm. As for the IOL power, keratometry seems to be the determining measure for calculating the IOL power in this study unlike the Gabonese series by Mba AT et al. [13] for which, axial length was the determining parameter. In the present series, the power was higher in men despite a greater axial length. The patients' state of instruction was not correlated with the keratometry and biometry parameters ( $p \geq 0.100$ ). However, from a practical point of view, the majority of non-instructed patients had a real problem with fixation and stability linked to comprehension. For these patients, keratometry and biometry by interferometry would be very useful.

## Conclusion

This study presents normative biometric parameters and their relationships in a Guinean population. It provided data on the keratometry, axial length and intraocular implant power of cataract surgery patients in Conakry. These values could serve as a reference for many centres in the country and during surgery campaigns for the Guinean population. A multicentre study should be carried out with a larger population size to gain a better understanding of these results.

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## Conflicts of Interest

The authors declare that they have no conflict of interest in relation to this study.

## References

1. Haute Autorité de Santé HAS (2018) Feuille de route, proposition de traitement de la demande du collègue d'orientation et d'information. Cataracte HAS 1-8 téléchargeable sur [www.has-sante.fr](http://www.has-sante.fr).
2. Kaur S, Sukhija J, Ram J (2021) Intraocular lens power calculation formula in congenital cataracts : Are we using the correct formula for pediatric eyes ? *Indian J Ophthalmol* 69: 3442-3445.
3. Yang F, Yang L, Ning X, Liu J, Wang J (2024) Effect of dry eye on the reliability of keratometry for cataract surgery planning. *J Fr Ophtalmol* 47: 103999.
4. Diallo JW, Meda N, Ahnoux-Zabsonre A, Yameogo C, Dolo M, et al. (2015) Résultats fonctionnels de la chirurgie de la cataracte par phacoalternative avec implantation en chambre postérieure : à propos de 300 cas à Bobo Dioulasso (Burkina Faso). *Pan Afr Med J* 20: 230-235.
5. World Medical Association (2001) Declaration of Helsinki. Ethical Principles for medical research involving human subjects <https://www.wma.net/policies-post/wma-declaration-of-helsinki/>.
6. Cordelette C, Arndt C, Vidal J (2018) Intérêt de la formule Holladay 2 dans le calcul de la puissance de l'implant intraoculaire pour les yeux de biométrie hors normes. *J Fr Ophtalmol* 41: 308-314.
7. Ferreira TB, Hoffer KJ, Ribeiro F (2017) Ocular biometric measurements in cataract surgery candidates in Portugal. *PLoS One* 12: e0184837.
8. Weekers R, Grieten J & Lekeux M (1963) Etude des dimensions de la chambre antérieure de l'œil humain. L'intumescence cristallinienne et ses conséquences chirurgicales. *Ophthalmologica* 146: 57-64.
9. Merriam JC, Nong E, Zheng L (2015) Optimization of the A constant for the SRK/T formula. *Open J Ophtalmol* 5: 108-114.
10. World Health Organisation WHO (2010) : Global data on visual impairment [www.who.int/blindness/globaldatafinalforweb.pdf](http://www.who.int/blindness/globaldatafinalforweb.pdf).
11. Djiguimé PW, Diomandé IA, Ahnoux-Zabsonré A, Konan VK, Meda TA, et al. (2015) Résultats de la chirurgie avancée de la cataracte par tunnelisation : à propos de 262 cas réalisés au CHR de Banfora (Burkina Faso). *Pan African Medical Journal* 22: 366.
12. Sovogui MD, Zoumanigui C, Camara F, Doukouré MB (2022) Aspects épidémiologiques et cliniques de la cataracte dans la région administrative de Kankan (Guinée). *Health Sci. Dis* 23: 77-80.
13. Mba Aki T, Nnang Essone JF, Assoumou PA, Anzunzoghé E, Agaya C, et al. (2019) Kératométrie et longueur axiale, pour le calcul de la puissance de l'implant intraoculaire des candidats à la chirurgie de la cataracte à Libreville. *Bull Med Owendo* 17: 28-35.
14. Yoon JH, Whang WJ (2023) Comparison of Accuracy of Six Modern Intraocular Lens Power Calculation Formulas. *Korean J Ophthalmol* 37: 380-386.
15. Huang Q, Y Huang, Luo Q, Fan W (2018) : Ocular biometric characteristics of cataract patients in western China. *BMC Ophthalmology* 18: 99-109.

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