Austin Journal of Clinical Ophthalmology

Open Access

Austin Publishing Group

Research Article

The Influence of Biometric Factors on Refraction Post Uncomplicated Phacoemulsification: About 86 Cases

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Received: September 06, 2023

Accepted: October 24, 2023

Published: October 31, 2023

Abstract

Aim: to evaluate the biometric factors that influence the refraction obtained after simple phacoemulsification using the SRK/T formula.

Methods: This is a prospective study of 86 eyes subjected to cataract surgery during a one-year period. The biometric factors evaluated include axial length, keratometry, lens thickness, anterior chamber depth and vitreous depth. The implant calculation formula employed was SRK/T, which is a commonly used method. All patients underwent phacoemulsification and implantation of a foldable intraocular lens into the capsular bag. Refraction was measured 30 days after surgery.

Results: the mean axial length was 23.16±0.53mm, mean K1 was 43.5±1.50D, mean K2 was 43±1.63D, mean anterior chamber depth was 3.03mm, mean lens thickness was 3.37mm, mean postoperative target refraction was 0.16±0.377D, and mean postoperative refraction obtained was -0.226±0.625D. Among the eyes, 18.92% had a postoperative refraction within ±0.5D, and a non-target refraction outside ±0.5D was found in 64 eyes. In addition, 30.23% of the eyes had a postoperative refraction within ±0.75D.

Conclusion: the SRK/T formula seems to be a dependable method for predicting postoperative refraction following cataract surgery. However, the accuracy of this prediction may be influenced by the axial length of the eye. Higher axial lengths are associated with a greater tendency towards myopia.

Keywords: Phacoemulsification; Biometry; SRK/T Formula ; Postoperative refraction

Introduction

Since the first intraocular lens implantation by Harold Ridley implanted in 1949; the goal of cataract surgery has evolved from functional vision to achieving an optimal postoperative refractive state according to the patient's preferences and expectations [1].

Refractive errors are frequent [2] and represent a major challenge to the success of the surgery, leading to disappointment for both surgeon and patient. Therefore, it is imperative to understand the various factors that influence postoperative refractive error in order to accurately estimate IOL power and reduce residual refractive error to achieve the best possible postoperative outcomes. Ocular biometry is a critical aspect of cataract surgery, as it encompasses the measurement of different anatomical eye parameters, such as keratometry (corneal curvature measurement), axial length (distance between cornea and retina), and anterior chamber depth. These measurements are used to determine the appropriate IOL power for implantation in cataract surgery. The calculation of the IOL power relies on specific mathematical formulas that incorporate preoperative biometric measurements. Keratometry and axial length are critical parameters in this calculation. It is important to recognize that other factors, such as the calculation formula used, corneal stability, lens thickness and anterior chamber depth, may affect the postoperative refractive outcome. Precise assessment of ocular biometry and appropriate selection of the intraocular lens power formula for each patient are critical to achieve optimal visual outcomes after cataract surgery.

The aim of our study is to evaluate the biometric factors that influence the refraction obtained after simple phacoemulsification, using the SRK/T formula.

Material and Methods

A prospective analytical cohort study was conducted on 86 eyes of 84 patients who underwent cataract surgery at the De-

Citation: Ihssan H, Hassina S, Krichen A, Serghini L, Elhassan A. The Influence of Biometric Factors on Refraction Post Uncomplicated Phacoemulsification: About 86 Cases. Austin J Clin Ophthalmol. 2023; 10(7): 1167.

partment of Ophthalmology B of the Ibn Sina University Hospital in Rabat, Morocco. The study was carried out over a period of one year, from June 2021 to July 2022.

General information, including name, gender, medical history, and clinical symptoms, were collected using a technical data sheet to simplify the process. The clinical study focused on determining the best preoperative corrected visual acuity, preoperative refraction, and the clinical classification of cataract according to the LOCS III system. Additionally, biometric factors were analyzed, specifically: Keratometry (K1, K2), axial length, lens thickness, anterior chamber and vitreous depth, and IOL power calculation were determined using an A-scan ultrasonic biometer (SIGHT ACCUTOME) with applanation technique under topical anesthesia. Keratometry was measured with an auto kerato-refractometer (Topcon KR 8000). We used the SRK/T formula with constant A 118 for IOL power calculation. The postoperative refraction targets slight myopia in all patients. It is important to note that all examinations and calculations were conducted by the same surgeon.

All participants in the study underwent uncomplicated cataract surgery using either the stop-and-chop or direct chop technique. The surgery was combined with placement of a Spectra Fold Aspheric foldable implant in the capsular bag. Follow-up appointments were scheduled for post-operative day 1, day 7, and day 15. Refraction was measured at day 30 post surgery.

Statistical Analysis

All statistical analyses were performed using non-parametric tests and using SPSS (software Version 21.0), the statistical significance limit was 0.05.

Results

A total of 86 eyes from 84 patients were included in the study. Of these, 44 (51.16%) were women and 42 (48.83%) were men; mean patient age was 70 years (range 54-90 years), mean axial length was 23.16±0.53 mm (range 20.06-29.02 mm), mean K1 was 43.5±1.50D (range 4 0.75-46.25), mean K2 was 43±1.63D (range 39.25-46.75D), mean anterior chamber depth found was 3.03mm (range 2.09mm to 3.98mm), mean lens thickness was 3.37mm (range 2.46mm to 5.01mm); the mean IOL power was 21.06±1.65D (range 4.00 to 29.00 D), the mean target postoperative refraction value was 0.16±0.377D (range 0.08 to O ,79 D), and the mean postoperative refraction obtained was -0.226±0.625D (range -2.00D to +2. 50 D)

Based on the statistical results, 22 patients or 18.92% of eyes fell within the ±0.5 D range of the postoperative refraction obtained; a non-targeted refraction outside ±0.5 D was found in 64 eyes (i.e. 74.41%); a percentage of 30.23 % eyes had a postoperative refraction within ±0.75 D of the Post-operative refractive deviation, of which 20 eyes were more myopic than 0.75D and only 6 patients were more hyperopic than +0.75 D.

Discussion

Among the first findings of the results of our case series, is the percentage of total prediction accuracy (without taking into account other biometric factors) of the SRK/T formula which reaches 20% for a refractive range obtained in the interval +0.5 and -0.5D, comparing our results with that of the KARABELA et Al study in 2017 which involved 538 cases, they concluded for a percentage of 38% prediction for emmetropic eyes using the SRK/T formula [3].

Lagrasta et al [4] showed a predictive accuracy of 55% for refractive error within ±0.50 D using the SRK/T formula in the eyes of 33 patients with average axial length (22.2-24.5 mm); in this study, four types of AcrySof IOL were implanted in the bag through a 3 mm incision.

Corrêa et al [5] conducted a retrospective review in 81 patients with axial length of 22 to 25mm using the SRK/T formula and presented residual refractive errors between ±0.50 in 40.7%; Bhatt et al [41] reported that 37.5% of eyes were within +/-0.50 D with predictions made using the SRK/T formula in their retrospective study which included 421 eyes of 304 patients.

Refractive deviation is the difference between the predicted preoperative refraction and the obtained postoperative refraction. A negative mean refractive deviation indicates a tendency towards myopia, while a positive mean indicates a tendency towards hyperopia. According to the results of our study, 36.12% of patients had a postoperative refraction of more than -0.5D, indicating a tendency towards myopia.

With regard to the various biometric factors studied, a statistically significant correlation was found between axial length and the postoperative refraction obtained; as axial length increases, the predictive accuracy of the postoperative refraction decreases; however, no significant correlation was found between the postoperative refraction obtained and the other biometric factors studied.

The strengths of our study are the prospective nature of the study, the use of a single biometric calculation technique by a single examiner, a single SRK/T implant calculation formula, the same A 118 constant, the same surgical technique and the same type of intraocular implant, which enabled us to reduce the various factors that can bias the results of our study. The only negative point is the size of the sample studied, but our study opens up different perspectives, in this case, the use of other implant power calculation formulas, or a detailed study of extreme axial lengths.

Conclusion

The results of our case series show that the SRK/T formula typically performs well in predicting postoperative refraction. This predictability's accuracy seems to correlate significantly with axial length, which typically results in a myopic shift postoperatively as the axial length increases. Nonetheless, we did not find any correlation with other biometric factors. This implies that in our study population, the SRK/T formula is a reliable predictor independent of these factors.

These results are based solely on our specific case series, implying a possible variation in other studies. Despite these findings, accurate assessment of axial length is crucial in cataract surgery planning and the selection of implant calculation formula. The axial length serves as an essential variable that affects the implant power required to ensure adequate postoperative refraction.

Additional biometric factors, such as keratometry, central corneal thickness, and corneal refractive power, should be taken into account to improve the accuracy of predicting postoperative refraction. A thorough assessment of these parameters can refine the implant calculation formula and optimize visual outcomes for individual patients.

Author Statements

Conflicts of Interest

The authors have no conflicts of interest to declare.

Sources of Funding

We have any financial sources.

Consent

Patients provided written informed consent to participate after being given a detailed explanation of the study.

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