The Research of Medical Science Review
ISSN: 3007-1208 & 3007-1216 Volume 2, Issue 3, 2024

IMPACT OF 2.75MM CLEAR CORNEAL INCISION ON REFRACTIVE OUTCOME IN PHACOEMULSIFICATION PATIENTS

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DOI: https://doi.org/10.5281/zenodo.18322255

Keywords
Postoperative, Anterior Segment, Astigmatism, Cornea.

Article History
Received: 30 October 2024
Accepted: 18 December 2024
Published: 31 December 2024

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Abstract

Introduction

The assessment of cataract and refractive surgery includes assessment of corneal curvatures, thickness, and anterior segment. The current study aims to evaluate the short-term changes in anterior segment characteristics and surgically induced astigmatism from pre and post-operative levels.

Methodology

This was a prospective observational study of patients undergoing ocular surgery at Paf Hospital Islamabad from 1st January 2024 to 30th June 2024. The study included fifty (50) patients. Patients of both genders were included. Data was stored and analyzed using IBM-SPSS version 23.0.

Results

The baseline characteristics of studied patients in the present study among fifty samples, 60% were females, 40% were data from left eyes, mean age of patients was 59.7 (SD=± 7.5), mean SIA at day-7 was 0.42 (SD= ± 0.13), pre-operative mean SPH was -0.31 (SD=±1.47), day-1 mean SPH was -0.05 (SD=±0.24), and day-7 mean SPH was 0.09 (SD=±0.73).

Conclusion

This study found that the majority of anterior segment refractive and keratometric changes occur on the first postoperative day, and by Day 7, most parameters were stabilized. These findings show that in normal practice, waiting until Day 7 for postoperative refractive or astigmatic evaluation is reasonable.

INTRODUCTION

Evaluation of cataract and refractive surgery involves assessing corneal curvatures, thickness, and anterior segment measurements. When considering refractive corneal surgery, essential metrics include cycloplegic refraction, corneal thickness, and curvature, while anterior chamber depth is also important. In high myopic eyes, phakic intraocular lenses (IOLs) are a viable option to excimer laser surgery due to important factors such as ACD, WTW, and ATA dimensions. These characteristics are crucial for determining IOL power prior to cataract surgery. However, the impact of cycloplegia on ocular biometry has received limited attention. Only one research found that cycloplegia increased ACD and WTW distance, but not axial length (AL) or corneal curvature [1].

Accommodation enables distant and close objects into clear focus on the retina by adjusting the diopteric power of the crystalline lens. Although the specific mechanism of accommodation is unknown, most ophthalmologists believe that ciliary muscle contraction is crucial in the process [2]. Evidence suggests that ciliary muscle contraction affects more than only the curvature of the crystalline lens [3-6]. Ciliary smooth muscle contraction causes an inward pushing force on the choroid and sclera surrounding the ciliary body. During the accommodation reaction, ciliary muscle contraction may result in a protrusion at the posterior sclera and a temporary extension of axial length [7].

Despite advances in surgical methods and instruments, modest postoperative changes in refractive and keratometric parameters can have a considerable impact on visual results and patient satisfaction. Early postoperative fluctuations in spherical power, cycloplegic refraction, and corneal curvature (K1 and K2) give important information about the anterior segment's stability and the extent of surgically induced astigmatism (SIA). Assessing these measures in the initial postoperative period aids in determining refractive stability and planning for optimal visual rehabilitation. The current study aims to evaluate the short-term changes in anterior segment characteristics and surgically induced astigmatism from pre and post-operative levels.

Methodology

This was a prospective observational study of patients undergoing ocular surgery at Paf Hospital Islamabad from 1st January 2024 to 30th June 2024. The study intended to assess early postoperative changes in anterior segment parameters and surgically induced astigmatism (SIA) at days 1 and 7 after surgery. The study included fifty (50) patients. Patients of both genders, aged between 25-85 years who underwent straightforward ocular surgery were eligible. Patients with prior ocular injuries, corneal pathology, intraoperative complications, or those who did not return for postoperative follow-up throughout the research period were excluded.

Demographic information such as age, gender, and the position of the operated eye were collected after obtaining approval from Ethical Research Committee. Anterior segment parameters, such as spherical power (SPH), cylindrical refraction, and keratometric readings (K1 and K2), as well as their axes, were assessed preoperatively, on postoperative day 1, and on day 7. Standard vector analysis (Alpine) methods were used to calculate surgically induced astigmatism (SIA) on day seven.All patients had routine surgical procedure conducted by skilled eye surgeons using aseptic methods. To guarantee uniformity, all measurements were collected under similar illumination and fixation circumstances.

Statistical Analysis

Data was stored and analyzed using IBM-SPSS version 23.0; counts with percentages were reported for gender and eye. Mean with standard deviation were given on age (years) and day-7 SIA of patients. Descriptives were given on SPH, Cylinder, k1 and K2 and their axis for pre, day-1 and day-7 level of treatment. Paired sample t-test was used to compare the before and after differences for these parameters from pre to Day-1, pre to Day-7 and Day-1 to Day-7. P-values less than 0.05 were considered statistically significant. Bar diagram and pie chart were also used to give graphical presentation of study outcomes.

Results

Table 1: Baseline Characteristics of Patients

Characteristics		n	%
Gender	Male	20	40.0
	Female	30	60.0

Eye	Right	30	60.0
	Left	20	40.0
Age (years)	Mean (SD)	59.7	±7.5
SIA at day 7	Mean (SD)	0.42	±0.13

Table-1 reports the baseline characteristic of studied patients, in the present study among fifty samples 60% were female gender, 40% were data from left eyes, mean age of patients was 59.7 (SD=± 7.5) and mean SIA at day-7 was 0.42 (SD= ± 0.13).

Table 2: Mean Comparison of Anterior Segment Parameters

Parameters	Pre		Day-1		Day-7		p-value pre vs. Day-1	p-value Pre vs. Day-7
	Mean	SD	Mean	SD	Mean	SD		
SPH	-0.31	1.47	-0.05	0.24	0.09	0.73	0.17	0.09
Cylinder	-1.23	0.77	-1.01	0.54	-0.96	0.54	0.001*	0.058
Cyl Axis	47.80	44.95	63.60	50.50	60.90	50.18	0.01*	0.059
K1	42.57	.76	42.36	0.76	42.38	0.77	<0.01*	0.12
K1 Axis	74.60	51.11	74.40	50.70	72.40	48.36	0.15	0.77
K2	43.65	.82	43.83	0.81	43.82	0.77	<0.01*	0.22
K2 Axis	108.40	55.08	106.8	54.1	108.40	54.84	0.32	0.99

Table-2 reports that at pre stage mean SPH was -0.31 (SD=±1.47), mean Cylinder was -1.23 (SD=±0.77), mean cylindrical Axis was 47.8 (SD=±44.95), mean K1 was 42.57 (SD=±0.76), mean K1 Axis was 74.6 (SD=±51.11), mean K2 was 43.65 (SD=±0.82), and mean K2 Axis was 108.4 (SD=±55.08), at day-1 mean SPH was -0.05 (SD=±0.24), mean Cyclinder was -1.01 (SD=±0.54), mean Cylindrical Axis was 63.6 (SD=±50.5), mean K1 was 42.36 (SD=±0.76), mean K1 Axis was 74.4 (SD=±50.7),mean K2 was 43.83 (SD=±0.81), and mean K2 Axis was 106.8 (SD=±54.1), whereas at day-7 mean SPH was 0.09 (SD=±0.73), mean Cylinder was -0.96 (SD=±0.54), mean Cylindrical Axis was 60.9 (SD=±50.18),mean K1 was 42.38 (SD=±0.77), mean K1 Axis was 72.4 (SD=±48.36), mean K2 was 43.82 (SD=±0.77), and mean K2 Axis was 108.4 (SD=±54.84). Paired sample t-test showed a significant mean difference for Cylinder, cylindrical axis, K1 and K2 from pre to Day-1 ($p<0.05$), however there was no significant mean difference found for these parameters from pre to Day-7 and Day-1 to Day-7 ($p>0.05$).

Discussion

The current study evaluated short-term changes in anterior segment characteristics and surgically induced astigmatism (SIA) after ocular surgery. The data revealed substantial differences in cylinder, cylindrical axis, and keratometric readings (K1 and K2) between the preoperative and first postoperative days, indicating a quick postoperative refractive and corneal response. However, by the seventh postoperative day, these measures were trending towards stability, with no statistically significant alterations from the baseline values. These findings indicate that most refractive and corneal alterations occur within the first 24 hours of surgery, followed by progressive recovery and optical stability in the early postoperative period.

The current study observed a significant mean difference in cylindrical refraction and axis between preoperative and Day 1 ($p < 0.05$), but not between preoperative and Day 7 or Day 1 and Day 7. This shows that the most significant change in refractive status occurred soon following surgery, with a trend towards stabilization during the first week. Such early refractive shifts may be caused by postoperative corneal edema, wound healing responses, anterior chamber depth alterations, or changes in effective lens position (ELP). Indeed, studies of postoperative refraction after cataract surgery demonstrate that refractive stability often occurs in the first few weeks, and delayed stabilization may account for refractive surprise when correction is tried prematurely [8]. Clinically, this supports the idea that refractive prescription should be postponed until early stability is established, and that early postoperative refractive measures may be erroneous.

The present study reported statistically significant changes in K1 and K2 levels from preoperative to Day 1 ($p < 0.01$), but no significant alterations from Day 1 to Day 7 or pre-to-Day 7. In our group, the axes of K1 and K2 showed no statistically significant changes. The literature on this subject is relatively varied. Some studies have found that contemporary small-incision cataract surgery results in relatively little corneal shape alterations, implying that the incision itself causes minimal astigmatism. A study, for example, found that cataract surgery had "a very small and variable effect on corneal shape" when very small incisions were used. Another research reported keratometric alterations of 0.54 ± 0.27 D following phacoemulsification, but the difference was not always clinically meaningful [9, 10].

The current investigation found a mean SIA of 0.42 ± 0.13 D on Day 7. This number is within the range described in the literature; for example, one vector-analysis research revealed induced astigmatism of around 0.41 ± 0.37 D at one week postoperative [11]. Another recent study found that alterations in posterior corneal curvature may lead to SIA, and that early week modifications are still changing [12]. In our study keratometric alterations had mainly stabilized by Day 7, suggesting that the SIA value we got was likely reflective of early refractive result. Nonetheless, the early timing (day 7) may occur before full wound healing and biomechanical stability, thus ongoing monitoring may reveal slight further alterations.

Certain limitations of the current study should be acknowledged. The follow-up period was brief (7 days); while our findings indicate early stabilization, a longer follow-up (e.g., 4-6 weeks or 3 months) would determine whether further modest alterations occurred. Second, the study did not examine posterior corneal curvature or biomechanical corneal factors, which may influence SIA and refractive stability. As this research shows, posterior corneal alterations might contribute significantly to overall corneal astigmatism.

Conclusion

In conclusion, this study shows that the bulk of anterior segment refractive and keratometric alterations occur within the first postoperative day, and by Day 7, most parameters had reached a stable plateau. The mean SIA at Day 7 was minimal (~0.42 D), indicating positive results with current surgery. These findings imply that in ordinary practice, waiting until Day 7 for postoperative refractive or astigmatic examination is appropriate, and that rapid refractive alterations should be taken with care. Patients and doctors contemplating refractive correction or toric IOL implantation will benefit from understanding this early stabilization phase. However patients could not be followed for a longer period of time so this was the major limitation of this study.

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