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Effect of surgical skill on surgically – induced astigmatism in cataract surgery

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白内障手术技巧对术源性散光的影响

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摘要

目的:评估行普通白内障超声乳化术,手术经验对术源性散光(SIA)的影响。

方法:选取患者 50 例 53 眼,平均年龄 64.5±10.8a,随机分为两组,一组 23 眼,二组 30 眼。手术方式均采用透明角膜切口白内障超声乳化吸除联合人工晶状体植入术。第一组由白内障专家手术,第二组则由住院医师手术。术前所有患者均接受全面眼科检查,包括角膜曲率和自动屈光检测。SIA 应用向量分析程序-Alpins 法计算,于术后 1d,1mo 及 2mo 重复上述检查并记录结果变化。应用 Shapiro Wilk 和 Mann-Whitney 检验判断两组间 SIA 的统计学差异。

结果:两组患者人口资料差异无统计学意义。组间分析显示,一组术后 1d,1mo 及 2mo 的 SIA 分别为 0.79±0.41 D,0.54±0.41 D 及 0.47±0.37 D;二组分别为 1.27±0.66 D,0.98±0.56 D 及 0.94±0.54 D。可见一组术后 1d (P=0.002),1mo (P=0.004)及 2mo (P=0.001)的 SIA 更小。

结论:手术经验是影响 SIA 的因素之一。住院医师应增加超声乳化术手术量以获取更多手术经验。

关键词:手术经验;白内障超声乳化术;术源性散光

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Abstract

• AIM: To evaluate the effect of surgical experience on surgically- induced astigmatism (SIA) in patients with uncomplicated phacoemulsification surgery.

• METHODS: Fifty-three eyes of fifty patients, mean age 64.5±10.8y, were randomly divided into two groups (23 eyes and 30 eyes). First group was underwent surgery by cataract specialists and the second was by residents. At baseline all the patients were underwent a complete opthalmological examination including keratometry and autorefractometer measurements. Vector analysis programme including the Alpins' method was used for the calculation of SIA. All the measurements were repeated postoperative first day, first month and second month and changes were recorded. Shapiro Wilk and Mann-Whitney tests were applied for determining the statistical differences between the SIA with two groups.

• RESULTS: There were no significant differences in demographic data of the groups. Intergroup analysis showed, first group was more effective results in SIA postoperative first day (P=0.002), first month (P=0.004) and the second month (P=0.001). For the first group, SIA were 0.79±0.41 diopter (D) at the first postoperative day, 0.54±0.41 D at the first postoperative month and 0.47±0.37 D at the second postoperative month. Second one was 1.27±0.66 D, 0.98±0.56 D and 0.94±0.54 D, respectively.

• CONCLUSION: According to the results, surgical experience was one of the factors that affects SIA. Residents would perform more phacoemilcification surgery to obtain more surgical experience.

• KEYWORDS: surgical experience; phacoemulsification; surgically induced astigmatism

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INTRODUCTION

Cataract is common cause of blindness in the world[1]. Surgery is the only treatment modality of the disease and it has been performed not only for cataract removal, also improving the refractive status of the cases for recent years[2-4]. Many advancements have been developed to prevent the complications of cataract surgery and provide better visual prognosis[3-7].

Surgically – induced astigmatism (SIA) remains common obstacle to achieve better visual prognosis[8-13]. SIA is related to the surgical technique, the type, length and location of the incision, the biomechanical features of the cornea and the suture closure technique, *etc*[5-13].

Surgical experience is very important factor and also related to get better surgical outcomes[14-20]. To our knowledge, the association between surgical experience with SIA has not been reported.

The main objective of this study was to investigate the association between surgical experience and SIA.

SUBJECTS AND METHODS

Fifty-three eyes of fifty patients, uncomplicated phacoemulsification and posterior chamber intraocular lens (PCIOL) implantation, were included in this study between January 2014 and June 2014 at Ulucanlar Eye Research Hospital. Study procedure was conducted in accordance with the Declaration of Helsinki and written informed consent was obtained from each patient. This study was approved by The Ethical Committee of Numune Training and Research Hospital. All patients were Turkish Caucasians.

Patients were older than 30-year-old with nuclear, corticonuclear, posterior subcapsular or white mature cataract that might affect the visual acuity at least 2 lines of Snellen charts, were included. Exclusion criteria was being younger than 30-year-old, had any type of glaucoma, pseudoexfoliation syndrome, dry eye, corneal diseases those might induce irregular astigmatism like keratoconus, had any ocular trauma history, surgery, contact lens, chronic inflammation and had systemic diseases affecting wound healing such as diabetes mellitus or romatoid arthritis. Complicated cataract surgery, for instance, vitreous loss, posterior capsule rupture, intraocular lens (IOL) dislocation and postoperative complications such as inflammation, hypotony or hypertony were also excluded.

Preoperatively all eyes were underwent a complete ophthalmological examination including best-corrected visual acuities with Snellen charts, anterior and posterior segment examinations, refractive and keratometric measurements by autorefractokeratometer (Topcon, KR-8100PA), intraocular pressure measurements with Goldmann applanation tonometer, central corneal thickness measurement by ultrasonic pachymeter and anterior segment and topographic analysis with Pentacam imaging system and biometry by noncontact optical biometer (Haag-Streit LENSTAR® LS 900 Optical Biometer, Switzerland). Complete ocular examinations including refractive and keratometric measurements by autorefractokeratometer were performed at the first day and first, second, fourth and eighth weeks postoperatively.

Age and sex-matched cases were randomly divided into 2 groups. For first group, surgeries were performed by 10 cataract specialists (≥10y's experience of cataract surgery, performed more than 1000 phacoemulsification and PCIOL implantation). Second group, 10 residents (between 1 and 5y of experience of cataract surgery, performed at least 50 phacoemulsification and PCIOL implantation) operated many surgeries under the supervision of cataract specialists.

Surgical Technique All operations were performed by cataract specialist and residents. Any complication was observed. The main incision was created at 12 o'clock position both right and left eyes under topical (Alcaine 0.5% Ophthalmic Solution Alcon) and subconjunctival (20 mg lidocaine hydrochloride and 0.0125 mg epinephrine) anesthesia. The clear corneal incision was made with a 2.8 mm disposable blade. Side port incision was performed by 23 G myringovitreoretinal (MVR) knife. Phocoemulsification was performed by the Alcon Infiniti system (Infiniti, Alcon Laboratories Inc.), the lens nucleus was removed via torsional phocotechnology, whereas cortex was removed aspiration and irrigation methods. A foldable hydrophobic single piece Acrylic IOL (Alcon AcrySof SA 60) was injected into the capsular bag. The viscosurgical device was removed by irrigation and aspiration system. Cefuroxime was injected into the anterior chamber. At the end of the surgery, all incisions were hydrated and left sutureless. Postoperatively, each patient received same treatment, moxifloxacin hydrochloride (Vigamox® 0.5% Ophthalmic Solution Alcon) four times per day for a week and prednisolone acetate (Predforte® 1% Ophthalmic Solution Allergan) four times per day for three weeks.

Surgicallly-Induced Astigmatism SIA was calculated according to vector analysis programme (http://www.drpeyman.ir/Ophthalmology_Calculator.htm) using the Alpin's method[16].

Statistical Analysis Statistical analyses were performed using SPSS for Windows (SPSS Inc., Chicago, IL, USA) software. The variables were investigated using visual and analytical methods (Shapiro Wilk Test) to determine whether or not they are normally distributed. Mann Whitney *U* test was applied for determining statistical significance of SIA vectors calculated Alpin's method, postoperative 1d, 1mo and 2mo between the groups. A *P* value of less than 0.05 was considered to show a statistically significant result.

Table 1 Demographic characteristics and the diagnosis of the cases *n*(%)

Parameters	No. of eyes and cases (*n*=53 eyes/50 cases)
Mean age±SD(range)	64.5±10.8(38-90y)
Sex	
F	24 cases (48%)
M	26 cases (52%)
Group	
1	23 eyes (43.4%)
2	30 eyes (56.6%)
Diagnosis	
Corticonuclear cataract	17 eyes (32.1%)
Posterior subcapsular cataract	16 eyes (30.2%)
Cortical cataract	17 eyes (32.1%)
Nuclear cataract	3 eyes (5.7%)

RESULTS

The mean age of the 26 (52%) male and 24 (48%) female was 64.5±10.8 (38-90y). First group was consisted of 23 eyes (43.4%) of 23 cases and the second 30 eyes (56.6%) of 27 cases (Table 1). The demografic data (age and sex) was similar both two groups (*P* = 0.885, *P* = 0.07 respectively). Thirty eyes were right and twenty-three were left. Sixteen eyes (30.2%) were detected posterior subcapsular, seventeen eyes (32.1%) corticonuclear, seventeen

Table 2 The SIA values of group 1 and 2 and the *P* values

SIA	Group 1 (cataract specialists)	Group 2 (residents)	*P*
Postoperative 1d	0.79±0.41 D	1.27±0.66 D	$P=0.002^a$
Postoperative 1mo	0.54±0.41 D	0.98±0.56 D	$P=0.004^a$
Postoperative 2mo	0.47±0.37 D	0.94±0.54 D	$P=0.001^a$

[a]Statistically significant.

eyes (32.1%) cortical, and remaining three eyes (5.7%) nuclear cataract (Table 1).

The SIA was demonstrated at postoperative 1d, 1mo and 2mo in Table 2. Intergroup analysis showed that, first group was more effective than the second group in decreasing SIA vectors (Table 2).

DISCUSSION

The objective of this study was to demonstrate the surgical experience was important factor in decreasing SIA along with surgical technique, the type, the site, incision location and biomechanical features of the cornea.

The most important goal of modern cataract surgery is to get perfect refractive outcome and rapid visual rehabilitation with minimal SIA. SIA is common cause of undesirable refractive outcomes. SIA may influence many factors such as surgical technique, incision characteristics and biomechanical fetures of cornea, *etc*[5-8]. Kawahara *et al*[5] investigated the effect of surgical technique on SIA in their prospective study. They performed coaxial phacoemulsification using one - handed technique in one eye and coaxial phacoemulsification using two-handed technique with a corneal side port in the fellow eyes of their cases. They did not find statistical significant difference in SIA between the groups and stated that corneal side port had a rotating effect on the axis of astigmatism. Chen *et al*[6] compared the surgical results of bimanual microincision cataract surgery (MICS) through 1.2 mm to 1.5 mm incision and standard coaxial small-incision cataract surgery through 2.8 mm to 3.2 mm incision in their meta-analysis and showed that bimanual surgery had an advantage of smaller SIA. Nagy *et al*[7] compared the effects of femtosecond laser-assisted and manual clear corneal incisions on SIA but they did not observe statistical significant difference in their study. In this study, standard coaxial small-incision cataract surgery was performed.

The characteristic of the incisions are the most important factors that affects SIA. Yoon *et al*[8] compared the effect of the incision site in their sudy. They performed bilateral cataract surgery with 3.0 mm temporal incisions in one eye and 3.0 mm nasal corneal incisions in the fellow eye and compared the refractive changes and SIA. They found there was no statistically significant difference in the mean SIA between the nasal and the temporal incisions. The incision location are also very important factors[9-10]. Wilczynski *et al*[9] compared SIA after coaxial 1.8 mm MICS and bimanual 1.7 mm MICS and there was no differences in SIA induced by both techniques. Luo *et al*[10] compared the refractive outcomes of cataract surgery with 1.8, 2.2, and 3.0 mm incision sizes. They stated that smaller incisions had an advantage of less SIA. In this study 2.8 mm clear corneal incisions were created at the steepest quadrants. Rho *et al*[11] also performed their 3 mm incisions at the steepest quadrants similar to in this study. They divided into their cases according to incision location, temporal, superior-temporal or superior and observed the SIA changes within the 2 postoperative months. They observed mean SIA of the superior incision was smaller than the temporal incision.

Corneal biomechanical properties may also affect SIA in cataract surgery. Denoyer *et al*[12] investigated the effect of elastic properties and wound-healing processes of the corneal tissue on the final refractive outcomes. They compared the corneal biomechanical properties measured by Ocular Response Analyzer preoperatively and 1, 7, and 30d postoperatively. They stated SIA was also significantly related to corneal hysteresis than the other properties of the incisions.

Surgical experience is important factor affecting the surgical success[17-20]. The main aim of residency surgical training is to prevent the complications and safety of patients. There are some assessments of surgical skill in ophthalmology such as wet laboratories with animal eyes. These tools are relevant to residents training in ophthalmology[17-20]. However in many countries residents do not have opportunity to use those tools, they perform surgeries through direct supervision throughout the learning period. Our residents not only perform surgeries in wet laboratories and also perform the surgeries through direct supervision. In this study we tried to standardized all conditions such as surgical technique, site and localization of main incision and side ports, phaco time, surgical tools, wound stress and stretching of corneal tissue, *etc*. except surgical experience, in addition, study was designed to avoid variation among individuals. All cataract specialists performed standard uncomplicated phacoemulsification and PCIOL implantation with 2.8 mm clear corneal incision at the steepest quadrant under the same conditions. The major limitation of this study was the lack of imaging systems. If we measured the dimensions of the incisions by imaging systems like anterior segment optical coherence tomography, our study had stronger results. Patients' ocular factors could be same whether one eye of patient is performed by cataract specialist and fellow eye by resident.

In conclusion, we found that surgical experience decreased SIA values and improved refractive outcomes after uncomplicated phacoemulsification surgery. The results of this study show that the importance of surgical experience on refractive outcomes. Residents should perform more surgeries

to avoid undesirable refractive outcomes. Further research will be needed to elucidate the potential role of surgical experience on SIA.

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