ORIGINAL ARTICLE

Arquivos Brasileiros de Oftalmologia

In-the-bag toric intraocular lens implantation in the case of an anterior capsule tear: a case series

Implantação de lentes intraoculares tóricas no saco capsular em casos de ruptura da cápsula anterior: uma série de casos

Panagiotis Dervenis[1], Nikolaos Dervenis[2], Dimitrios Chiras[2]

1. Faculty of Health Sciences, Aristotle University of Thessaloniki, Thessaloniki, Greece.
2. Moorfields Eye Hospital, London, UK.

ABSTRACT | Purpose: To analyze the outcomes of in-the-bag toric intraocular lens implantation for anterior capsular tears during phacoemulsification. **Methods:** The cohort of this retrospective, consecutive, interventional case series included eight patients. One patient was excluded as the tear was used to enlarge the rhexis. The mean preoperative astigmatism was -1.67D (± 0.98) and the mean preoperative unaided logMAR visual acuity was 0.62 (± 0.76). The mean angle between the anterior capsule tear and the closest intraocular lens haptic was 51.25° (range, 30°-90°). **Results:** The final unaided logMAR visual acuity was 0.16 (± 0.21) and the final cylinder was -1.1 D (± 0.59). The mean follow-up duration was about 2 ± 1.2 months. In this case series, no lens had to be explanted or rotated postoperatively. Placement of a toric intraocular lens in the presence anterior capsule tear was safe in all patients. An angle of at least 30° remained between the tear and the intraocular lens haptic. **Conclusion:** Placement of toric intraocular lens in the presence of an anterior capsule tear may be safe, at least in cases with a 30° angle between the anterior capsule tear and the intraocular lens haptic.

Keywords: Phacoemulsification/adverse effects; Cataract; Lens implantation, intraocular; Visual acuity

RESUMO | Objetivo: Analisar os resultados do implante de lentes intraoculares tóricas para rupturas capsulares anteriores durante a facoemulsificação. **Métodos:** A coorte desta série retrospectiva, consecutiva e intervencional de casos que inclui 8 pacientes. Um paciente foi excluído quando a lágrima foi usada para aumentar a rexe. O astigmatismo pré-operatório médio foi de -1,67 D (± 0,98) e a média da acuidade visual logMAR sem intervenção pré-operatória foi de 0,62 (± 0,76). A média do ângulo entre a ruptura da cápsula anterior e o háptico mais próximo da lente intraocular foi de 51,25° (variação, 30°-90°). **Resultados:** A acuidade visual logMAR final sem ajuda foi de 0,16 (± 0,21) e o cilindro final foi de -1,1 D (± 0,59). O tempo médio de acompanhamento foi de aproximadamente 2 ± 1,2 meses. Nesta série de casos, nenhuma lente teve que ser removida ou rotacionada no pós-operatório. A colocação de uma lente intraocular tórica na presença de uma ruptura da cápsula anterior mostrou-se segura em todos os pacientes. Um ângulo de pelo menos 30° permaneceu entre a ruptura e o háptico da lente intraocular. **Conclusão:** A colocação de lente intraocular tórica na presença de uma ruptura da cápsula anterior pode ser segura, pelo menos em casos com um ângulo de 30° entre a ruptura da cápsula anterior e o háptico da lente intraocular.

Descritores: Facoemulsificação/efeitos adversos; Catarata; Implante de lente intraocular; Acuidade visual

INTRODUCTION

Cataract surgery (CS) is considered to be a refractive surgery as the refractive status of the patient is changed. Astigmatism of 1.5D or greater is found in about 20% of patients[1] and toric intraocular lenses (IOLs) have been developed for the management of astigmatism during CS. A significant limitation of toric IOLs is that rotation may affect the power of astigmatic correction. If emmetropia is not achieved after phacoemulsification, the use of glasses may be necessary postoperatively[2,3].

Intraoperative complications affecting the long-term stability of the capsule-IOL complex such as, zonular dialysis, vitreous loss, anterior capsule tear (ACT), and posterior capsule rupture, have been traditionally considered as relative contraindications for the placement of a toric IOL[4]. ACT is an intraoperative complication of CS that may affect the early postoperative stability of

Submitted for publication: December 18, 2018
Accepted for publication: January 22, 2019

Funding: No specific financial support was available for this study.

Disclosure of potential conflicts of interest: None of the authors have any potential conflicts of interest to disclose.

Corresponding author: Nikolaos Dervenis.

9 St Aidans Road, Carlisle, CA1 1LT. E-mail:nikosdervenis@gmail.com

Approved by the following research ethics committee: Audit department, Moorfields Eye Hospital (# CA17-CT-11).

 http://dx.doi.org/10.5935/0004-2749.20190088

the placed IOL, thereby necessitating further surgical intervention[5-7]. However, isolated ACT does not always preclude in-the-bag 1-piece IOL implantation[7]. The aim of the present study was to assess the outcomes of in-the-bag toric IOL implantation in ACT. In these cases, there is an additional risk of inadequate astigmatic correction because of IOL rotation.

METHODS

The protocol of this retrospective, consecutive, interventional case series was approved by the Institutional Review Board of Moorfields Eye Hospital (London, UK) and was conducted in accordance with the tenets of the Declaration of Helsinki. Preoperative, intraoperative, and postoperative data were collected for analysis. Precautions were taken to protect the identity of the study participants. The electronic medical records of cataract patients undergoing phacoemulsification surgery with toric IOL placement between 2014 and 2017 were screened for the presence of ACT.

The inclusion criteria were the presence of ACT and placement of toric IOL in-the-bag. The exclusion criteria were other related complications, such as posterior capsule tears, vitreous loss, and zonular dialysis. Additionally, cases with missing data regarding the postoperative refraction and those with a refraction obtained earlier than 3 weeks after surgery were excluded.

The Infinity and Centurion phacoemulsification platforms (Alcon Laboratories, Fort Worth, TX, USA) were used for all the patients. The guidelines for toric IOL selection included at least 2D of regular astigmatism, as confirmed with a Pentacam Scheimpflug imaging system (Oculus, Inc., Lynnwood, WA, USA). The AcrySof® IQ toric IOL series (SN6AT3, SN6AT4, SN6AT5, SN6AT6, SN6AT7, SN6AT8, and SN6AT9) were used after patient consultation and consent. The institutional guidelines suggested the use of the Hoffer Q IOL power prediction formula for eyes with an axial length shorter than 22.0 mm and the SRK-T lens formula for all other axial lengths. The online AcrySof® toric IOL calculator (http://www.acrysoftoriccalculator.com/) was used to calculate the power and positioning of the toric IOL. No patient had previous laser refractive surgery in this case series.

Trained technicians performed the preoperative biometric examinations using the IOL Master (Carl Zeiss Meditec, Dublin, CA, USA). If a signal-to-noise ratio lower than 2.1 was obtained with IOL Master, contact A-scan ultrasound biometry was used alternatively with the Accutome A-scan Plus (AccutomeInc., Malvern, PA, USA). Snellen visual acuity values were converted to the logarithm of the minimal angle of resolution (logMAR) value equivalents for the purpose of this study. The value of 2.3 was used for the logMAR visual acuity of a patient with visual acuity of hand motion preoperatively. Preoperative refraction was documented from the patient notes and postoperatively, the auto-refraction (RM-8800; Topcon Medical Systems, Inc., Oakland, NJ, USA) was used to assess the refractive outcome.

IBM SPSS Statistics for Windows, version 24.0 (IBM Corporation, Armonk, NY, USA) was used to perform all statistical analyses.

RESULTS

In this population, toric IOLs were placed in the capsular bag of eight patients with ACT. One patient was excluded from the analysis as the tear was used to enlarge the rhexis, which resulted in a continuous curvilinear capsularhexis.

Of the seven patients who received a toric IOL, three were male and four were female with a mean age of 61.71 years. One patient had early age-related macular degeneration and one had early glaucoma. The mean preoperative logMAR visual acuity was 0.62, the mean Kmin value was 42.24, and the mean Kmax value was 45.06. Table 1 summarizes preoperative descriptive statistics of all patients.

The SN6AT4 IOL was used in one patient, the SN6AT5 in four, and the SN6AT8 in two. The mean predicted postoperative spherical equivalent was -0.18D and the mean predicted postoperative cylinder was 0.18. The mean degree between the IOL haptic and the ACT was 51.25° with a range between 30° and 90°. Table 2 summarizes the IOL selection and the predicted refractive outcomes.

Table 1. Descriptive statistics of patients with ACT and in-the-bag toric IOL

Variable	
Sex	
Male	n=3, 42.9%
Female	n=4, 57.1%
Age, mean (SD)	61.71 (11.29)
Preop Kmin, mean (SD)	42.24 (1.01)
Preop Kmax, mean (SD)	45.06 (1.65)
Preop sphere, mean (SD)	0.54 (4.05)
Preop cylinder, mean (SD)	-1.67 (0.98)
Preop logMAR visual acuity, mean (SD)	0.62 (0.76)
Axial length, mean (SD)	24.05 mm (1.8)

The mean unaided logMAR visual acuity at 3 weeks after surgery was 0.21 and the final unaided logMAR visual acuity during the follow-up period was 0.16. The mean follow-up period was about 2 months. Table 3 summarizes postoperative visual acuities and refractive outcomes.

In this case series, the visual acuity outcomes were similar to those observed with toric IOL placement in cases where the capsular bag is intact[4,8-10].

DISCUSSION

An anterior capsular tear is a common intraoperative complication of CS, developing in about 1% of cases. IOL decentration has been associated with the development of anterior capsular bag defects and IOL orientation has been associated with the risk of decentration[11].

Several factors may be associated with the long-term stability of IOLs in the capsular bag, including axial length, axis of implantation, extent of capsulorhexis, complete viscoelastic removal at the end of surgery, residual soft lens matter, and IOL design[4,12,13].

The need for surgical repositioning is a complication of toric IOL with an incidence in the literature varying from 0.653% to more than 3%[14,10,13-16]. In this small case series, no IOL had to be repositioned.

Table 2. IOL selection, predicted refractive outcomes, and degrees between the haptic IOL and ACT

Variable	
Toric IOL	
SN6AT4	n=1 (14.3%)
SN6AT5	n=4 (57.2%)
SN6AT8	n=2 (28.6%)
Predicted postop spherical equivalent, mean (SD)	-0.18 (0.15 D)
Predicted postop cylinder, mean (SD)	0.18 D (0.16)
Degrees between ACT and IOL haptic, mean (SD) range	51.25 (26.6), 30^0-90^0

Table 3. Visual acuity, refractive outcomes, and follow-upduration

Variable	Mean (SD)
Three weeks unaided logMAR visual acuity	0.21 (0.20)
Three weeks best corrected logMAR visual acuity	0.07 (0.01)
Three weeks sphere	-0.29 (0.55)
Three weeks cylinder	-1.30 (0.75)
Final unaided logMAR visual acuity	0.16 (0.21)
Final best corrected logMAR visual acuity	0.05 (0.08)
Final sphere	-0.25 (0.56)
Final cylinder	-1.10 (0.59)
Follow-up in months	1.96 (1.19)

To the best of our knowledge, this is the first study to assess the use of toric IOLs in cases of ACT.

An optimal surgical technique is required for the use of toric IOLs. However, our outcomes suggest that toric IOL implantation is a viable option for carefully selected ACT patients. In the present series, an angle of at least 30° remained between the ACT and the IOL haptic.

REFERENCES

1. Ostri C, Falck L, Boberg-Ans G, Kessel L. The need for toric intraocular lens implantation in public ophthalmology departments. Acta Ophthalmologica. 2015;93(5):e396-7.
2. Behndig A, Montan P, Stenevi U, Kugelberg M, Zetterström C, Lundström M. Aiming for emmetropia after cataract surgery: Swedish National Cataract Register study. J Cataract Refract Surg. 2012;38(7):1181-6.
3. Wilkins MR, Allan B, Rubin G; Moorfields IOL Study Group. Spectacle use after routine cataract surgery. Brit J Ophthalmol. 2009; 93(10):1307-12.
4. Visser N, Bauer NJ, Nuijts RM. Toric intraocular lenses: historical overview, patient selection, IOL calculation, surgical techniques, clinical outcomes, and complications. J Cataract Refract Surg. 2013;39(4):624-37.
5. Marques FF, Marques DM, Osher RH, Osher JM. Fate of anterior capsule tears during cataract surgery. J Cataract Refract Surg. 2006;32(10):1638-42.
6. Olali C, Ahmed S, Gupta M. Surgical outcome following breach rhexis. Eur JOphthalmol. 2007;17(4):565-70.
7. Carifi G, Miller MH, Pitsas C, Zygoura V, Deshmukh RR, Kopsachilis N, et al. Complications and outcomes of phacoemulsification cataract surgery complicated by anterior capsule tear. Am J Ophthalmol. 2015;159(3):463-9.
8. Holland E, Lane S, Horn JD, Ernest P, Arleo R, Miller KM. The AcrySof Toric intraocular lens in subjects with cataracts and corneal astigmatism: a randomized, subject-masked, parallel-group, 1-year study. Ophthalmology. 2010;117(11):2104-11.
9. Mendicute J, Irigoyen C, Aramberri J, Ondarra A, Montés-Micó R. Foldable toric intraocular lens for astigmatism correction in cataract patients. J Cataract Refract Surg. 2008;34(4):601-7.
10. Kessel L, Andresen J, Tendal B, Erngaard D, Flesner P, Hjortdal J. Toric intraocular lenses in the correction of astigmatism during cataract surgery: a systematic review and meta-analysis. Ophthalmology. 2016;123(2):275-86.
11. Davison JA. Analysis of capsular bag defects and intraocular lens positions for consistent centration. J Cataract Refract Surg. 1986;12(2):124-9.
12. Shah GD, Praveen MR, Vasavada AR, Vasavada VA, Rampal G, Shastry LR. Rotational stability of a toric intraocular lens: influence of axial length and alignment in the capsular bag. J Cataract Refract Surg. 2012;38(1):54-9.
13. Oshika T, Inamura M, Inoue Y, Ohashi T, Sugita T, Fujita Y, et al. Incidence and outcomes of repositioning surgery to correct misalignment of toric intraocular lenses. Ophthalmology. 2018; 125(1):31-5.
14. Chang DF. Comparative rotational stability of single-piece open-loop acrylic and plate-haptic silicone toric intraocular lenses. J Cataract Refract Surg. 2008;34(11):1842-7.
15. Bissen-Miyajima H, Negishi K, Hieda O, Kinoshita S. Microincision hydrophobic acrylic aspheric toric intraocular lens for astigmatism and cataract correction. J Refract Surg. 2015;31(6):358-64.
16. Waltz KL, Featherstone K, Tsai L, Trentacost D. Clinical outcomes of TECNIS toric intraocular lens implantation after cataract removal in patients with corneal astigmatism. Ophthalmology. 2015;122(1):39-47.