Ophthalmology and Eye Diseases

ORIGINAL RESEARCH

Aphakia Correction by Injection of Foldable Intra Ocular Lens in The Anterior Chamber

Kagmeni Giles[1,2,*], Moukouri Ernest[1,2], Domngang Christelle[3], Nguefack-Tsague Georges[2], Cheuteu Raoul[1], Ebana Mvogo Come[2] and Peter Wiedemann[4]

[1]University Teaching Hospital Yaounde (UTHY), Cameroon. [2]University of Yaoundé I, Faculty of Medicine and Biomedical Sciences, Cameroon. [3]Mountains University Baganté, Cameroon. [4]Eye Hospital of Leipzig University, Germany.
*Corresponding author email: dr.kagmeni@gmx.net

Abstract: We assessed the outcomes of the use of anterior chamber foldable lens for unilateral aphakia correction at the University Teaching Hospital of Yaounde. In this retrospective, non-comparative, consecutive case series study, we reviewed the records of patients who underwent an operation for aphakia correction by the means of injection of an angular supported foldable lens between January 2009 and December 2011 in the University Teaching Hospital Yaounde. Student's paired *t*-test was carried out to compare pre-operative and post-operative visual acuity (VA) and intraocular pressure (IOP). *P*-values less than 0.05 were considered statistically significant. Twenty-one patients were included in the study; twelve were male (57.1%) and nine were female (42.9%). The mean age was 55.38 ± 17.67 years (range 9–75 years). The mean follow-up duration was 5.95 ± 3.14 months (range 2–12 months). The mean log-MAR visual acuity was 1.26 ± 0.46 pre-operatively and 0.78 ± 0.57 post-operatively ($P = 0.003$). The change in intraocular pressure was not statistically significant. Complications included intraocular hypertension (over 21 mmHg) in 3 patients (14.3%) and macular edema, pupillar ovalization, and retinal detachment in one patient each. The results indicate that injection of an angular support foldable lens in the anterior chamber is a useful technique for the correction of aphakia in eyes without capsular support. More extended follow-up, however, and a larger series of patients are needed to ascertain the effectiveness and safety of this procedure.

Keywords: unilateral aphakia, fordable lens, anterior chamber

Ophthalmology and Eye Diseases 2013:5 17–22

doi: 10.4137/OED.S12672

This article is available from http://www.la-press.com.

Introduction

Uncorrected unilateral aphakia is one of the leading causes of monocular visual impairment in some African countries.[1,2] Aphakic glasses, contact lenses, and intraocular lens (IOL) have been proposed as methods of visual rehabilitation after cataract surgery. Spectacles are very inconvenient; they are heavy and uncomfortable. Lenses scratch easily and glasses frames can break easily. It is difficult in many African's countries such as Cameroon to replace spectacles once broken or damaged because of their expense and unavailability. They are unsuitable for monocular aphakia and restrict visual rehabilitation. Contact lenses are expensive and not easy to manage. The majority of the population lives in rural areas where suboptimal living standards and scarcity of clean water makes personal and ocular hygiene difficult. The polymethylmetacrylate (PMMA) anterior chamber (AC) lens has long been considered as a standard method of aphakia correction in Africa. This has been linked to various complications including bullous keratopathy, increase of intra ocular pressure (IOP), and endothelial cell loss or even visual loss. Several techniques including posterior chamber sclera fixed lens,[3,4] and anterior chamber iris claw lens[5] have been reported to result in good visual outcome in the management of unilateral aphakic eyes without capsular support. Technological advances in lens design (angular support) and in lens material (Acrysoft) has permitted the safe use of lens in the anterior chamber for refractive error correction.[6,7] The aim of the current study was to determine the outcome of using the anterior chamber (AC) foldable lens for unilateral aphakia at the University Teaching Hospital Yaoundé (UTHY).

Material and Methods

Patients

In this retrospective, non-comparative, consecutive case series study, the records of all patients who underwent an operation for aphakia correction by the means of injection of angular support foldable lens in the anterior chamber between January 2009 and December 2011 in the University Teaching Hospital Yaounde were reviewed. Written informed consent was obtained after explaining the nature of the procedure from all patients (or legal relatives) before surgery. Preoperatively, each patient underwent a detailed ocular history (indicating the cause of aphakia) and a standard eye examination including testing of uncorrected and pinhole distance visual acuity, measurement of the intra ocular pressure (IOP) by Goldmann applanation tonometer, slit lamp examination focusing on the corneal details, and gonioscopy, fundus, and retinal periphery examination. Biometry and anterior chamber depth were measured using the Ocuscan (Alcon, Fort Worth, TX, USA). The horizontal diameter of the iris was measured manually using a caliper from white-to-white (WTW).

Inclusion criteria were unilateral aphakia with no clinical keratopathy, no evidence of glaucoma, open irido corneal angle, AC depth greater than 3 mm, WTW greater than 11.5 mm, and amelioration of the visual acuity with the pinhole.

Visual acuity definitions

In this current study, visual acuity was measured using letters on the Snellen chart and converted into logMAR units for statistical purposes. Non-numerical vision was arbitrary assigned a logMAR value So, counting finger (CF) = logMAR 1.70, hand motion (HM) = logMAR 2.00 intact light perception = logMAR 2.30, defect light perception = logMAR 2.70, and no light perception (NLP) = logMAR 3.00.

Lens characteristics

All IOLs used in this study were foldable acrylic with angular support. Only those with total diameter of 12.00–13.50 mm were disposable in our hospital. The overall diameter of lens to be implanted was accepted to be WTW plus 1 mm.

Surgical procedure

All surgeries were conducted under local anesthesia. Retro or para bulbar injection of 2% xylocaine was used. One 1-mm paracentesis was made at the upper nasal position and one 2.80–3.00 mm clear corneal tunnel incision was made at the upper temporal position with the keratoma. A viscoelastic substance was used to reform the AC. The foldable lens with the angular support was then injected gently in the anterior chamber (Figs. 1 and 2). The viscoelastic substance was removed from the anterior chamber with the Simcoe cannula. Patients presenting with an iridectomy from the ICCE did not require an additional iridectomy. At the end of the procedure, a subconjonctival

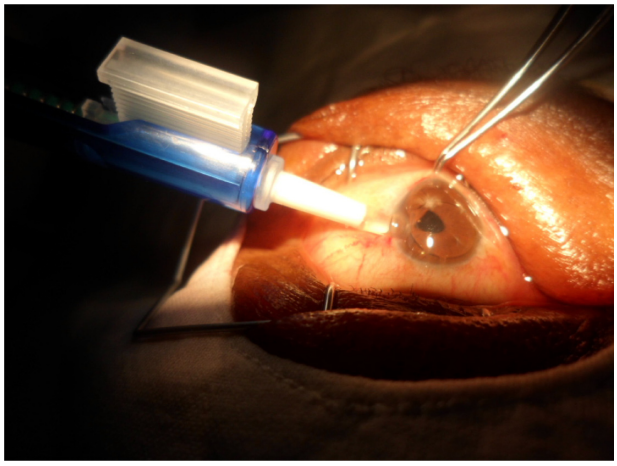

Figure 1. Anterior chamber lens injection through 2.8-mm clair corneal tunnel.

depot of dexamethasone and gentamicine was given. Follow-up visits were scheduled as follows: one day, one week, two months, six months, and one year following surgery. At each follow-up visit, UCVA and IOP were assessed and cornea status was analyzed. For each patient, data from the last follow-up visit were used for analysis.

Statistical analysis

Quantitative variables did not deviate significantly from the normal distribution; thus, their values were reported as mean ± standard deviation (SD). As results all tests carried out were parametric. Qualitative variables were presented in percent (%). Student's paired *t*-test was carried out to compare post-operative and pre-operative visual acuity (VA) and intraocular pressure (IOP). The analysis was performed using statistical software Epi-Info 7 and IBM SPSS 19. *P*-values less than 0.05 were considered statistically significant.

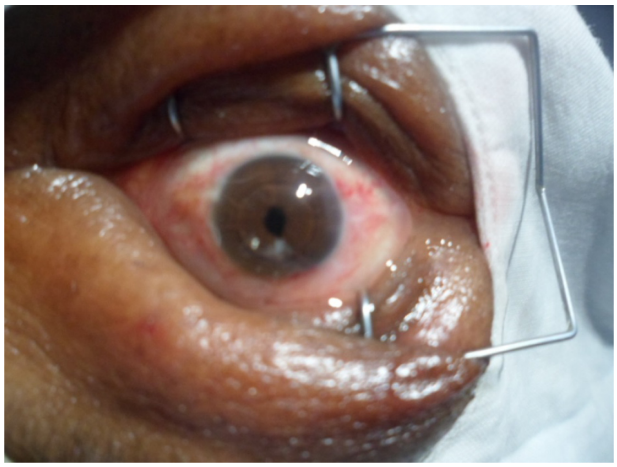

Figure 2. Anterior chamber lens after implantation.

Results

Twenty-one (21) patients were included in the study. The demographics and baseline eye characteristics for all patients are presented in Table 1. Twelve patients were male (12 eyes, 57.10%) and nine were female (9 eyes, 42.90%). Mean age was 55.38 ± 17.67 years (range 9–75 years). Aphakie causes included: 11 planed ICCE (52.38%), 6 inadvertence posterior capsule rupture with vitreous lost during planed ECCE (28.57%), 3 post-traumatic lens subluxation (14.28%), and 1 sinking lens (4.76%). The mean follow-up duration (Table 2) was 5.95 ± 3.14 months (range 2–12 months). Fifteen (71.40%) patients showed an increase of the post operative UCVA of one line or more. The mean visual acuity in logMAR was 1.26 ± 0.46 pre-operative and 0.78 ± 0.57 post-operative ($P = 0.003$). Three patients presented a post-operative VA less than pre-operative VA. Post operative complications are recorded in Table 3. Three patients (14.30%) had postoperative intraocular hypertension (over 21 mmHg). The change in intraocular pressure was not statistically significant ($P = 0.32$) from pre-operative IOP mean of 15.33 ± 3.21 mmHg to post-operative IOP mean of 16.52 ± 4.68 mmHg. Others complications included macula edema, pupillar ovalization (Fig. 3), and retinal detachment in one patient each. No corneal problem requiring lens removal was registered.

Discussion

The management of unilateral aphakic eye without capsular support has not been well-established in Cameroon. Foldable lenses with angular support are currently used in the anterior chamber for refractive error correction.[7] In this study, we injected a foldable lens with angular support in the anterior chamber to correct the aphakia. All patients presented a unilateral aphakia without capsular from various etiologies. Planed intra-capsular cataract extraction (52.38%) was the leading cause of aphakia in our series. This technique has long been considered a standard method of cataract operation in Africa.[8] We are unable to explain a slight difference in results

Table 1. Demographic and clinical data of 21 patients who underwent unilateral aphakia correction by means of injection of angular support foldable lens in the anterior chamber.

Patients	Age (Y)	Sex (M/F)	Pre op VA (logMAR)	Pre op IOP (mmHg)	Post op VA (logMAR)	Post op IOP (mmHg)	Follow-up (m)	Complications
1	66	F	1.0	15	1.6	14	4	None
2	69	M	1.0	16	0.1	19	7	None
3	71	F	1.7	12	0.5	12	8	None
4	69	M	0.7	20	0.5	19	2	None
5	64	F	1.0	13	0.7	24	10	IOP elevation
6	26	M	1.7	16	0.4	16	3	None
7	9	M	1.7	12	0.7	16	12	None
8	50	M	1.7	19	0.5	14	4	None
9	70	M	1.0	13	1.0	26	3	IOP elevation
10	63	M	1.0	13	1.7	15	8	Macula edema
11	64	M	1.7	16	1.7	16	5	None
12	40	M	0.7	17	0.5	16	2	None
13	63	M	0.5	21	0.4	20	3	Pupillar ovalization
14	40	F	1.0	11	0.4	14	7	None
15	67	F	1.7	18	0.4	25	5	IOP elevation
16	38	F	0.5	12	0.3	13	8	None
17	60	M	1.0	11	1.0	12	12	None
18	75	F	1.7	17	0.5	19	3	None
19	64	F	1.7	19	2.3	6	3	Retina detachment
20	63	F	1.7	19	0.6	15	8	None
21	32	M	1.7	12	0.6	16	8	None

Abbreviations: F, female; M, male; pre op VA, pre-operative visual acuity; post op VA, post-operative visual acuity; pre op IOP, pre-operative intra-ocular pressure; post-op IOP, post-operative intra-ocular pressure; Y, year; m, month.

between male and female patients. This may be linked to the finding that the male gender can easily pay the operation fee in Cameroon. Fifteen (71.40%) patients showed increased post-operative UCVA of one line or more. The mean visual acuity increased significantly from logMAR 1.26 ± 0.46 pre-operative to logMAR 0.78 ± 0.57 post-operative ($P = 0.03$). Previous studies using an iris claw lens to correct aphakia reported significant VA improvement and a low rate of complications.[4,13] However, despite the good visual outcome, implementation of iris claw techniques is difficult in Cameroon as it requires specialized equipment and a long training period. The insertion of a foldable lens in anterior chamber is a very easy procedure through a 2.80–3 mm clear corneal tunnel. In the current study, 3 eyes developed of post operatively a transient IOP elevation, which was managed with topical medications. This change in IOP was not statistically significant ($P = 0.32$). This was also reported in many studies[10,11] in which others approaches were used to correct aphakia. A case of pupillar ovalization observed in our series was also noted in another study.[12] This aesthetic concern had no clinical implication. Retinal detachment

Table 2. Means of age, follow-up, VA, and IOP pre- and post-operation.

Quantitative variables	Mean	Standard deviation	Minimum	Maximum
Age (years)	55.38	17.67	9	75
Follow-up duration (months)	5.95	3.14	2	12
Pre op VA	1.26	0.46	0.5	1.7
Post op VA****	0.78	0.57	0.1	2.3
Pre op IOP (mmHg)	15.33	3.21	11	21
Post op IOP (mmHg)^{NS}	16.52	4.68	6	26

Notes: ****$P = 0.003$; $^{NS}P = 0.32$.
Abbreviations: IOP, intraocular pressure; VA, visual acuity.

Table 3. Distribution of patients by type of complications.

Type of complications	Number	Percent (%)
None	15	71.4
IOP elevation	3	14.3
Macula edema	1	4.8
Pupillar ovalization	1	4.8
Retinal detachment	1	4.8
Total	21	100.0

resulted in lower visual acuity in our series. In our practice conditions, endothelial cell count was not measured. However, no case of bullous keratopathy was observed. There are two explanations for this: (1) in this study, all patients had an anterior chamber depth greater than 3 mm. This provides a sufficient distance between the lens and corneal endothelium, thus minimizing the endothelium cells loss; (2) the lens design (angular support) offers a smooth contact to irido corneal angle. In one series of 30 eyes, Omulecki et al[10] observed that mean corneal endothelial cell density gradually decreased in the postoperative period after implantation of the foldable AC IOL. A percentage of endothelial cell loss of 8.96% after 6 months was reported in eyes following iris claw intraocular lens implantation.[14] The mean follow-up duration of 5.95 ± 3.14 months (range 2–12 months) was short and constitutes a major limitation of this study. Regular follow-up visits to eye care clinics are problematic because of cost and travel distance. Adequate counseling of patients, parents, and caregivers will help to secure better follow-up.

Figure 3. Pupillar ovalisation following a foldable angular support lens implantation (patient nr 7).

Conclusion

Our results showed that foldable IOL injection in the anterior chamber improved visual acuity; the complications were similar to those reported in the literature using other methods. The technique is particularly suitable in Africa in that it is cost-effective, no long training period is required, and angular support foldable intraocular lenses are available. Although the visual outcome was good for most patients in this series, more extended follow-up and a large series of patients are needed to ascertain the effectiveness and safety of this procedure. Aphakia prevention by performing modern cataract operation such as small incision cataract surgery with posterior chamber IOL implantation remains the best solution.

Author Contributions

Conceived and designed the experiments: KG, ME, PW. Analyzed the data: KG, NTG. Wrote the first draft of the manuscript: KG, DC, CR. Contributed to the writing of the manuscript: KG, DC, CR, EMC, NTG. Agree with manuscript results and conclusions: All authors. Jointly developed the structure and arguments for the paper: KG, DC, CR, NTG. Made critical revisions and approved final version: ME, EMC, PW. All authors reviewed and approved of the final manuscript.

Funding

Author(s) disclose no funding sources.

Competing Interests

Author(s) disclose no potential conflicts of interest.

Disclosures and Ethics

As a requirement of publication the authors have provided signed confirmation of their compliance with ethical and legal obligations including but not limited to compliance with ICMJE authorship and competing interests guidelines, that the article is neither under consideration for publication nor published elsewhere, of their compliance with legal and ethical guidelines concerning human and animal research participants (if applicable), and that permission has been obtained for reproduction of any copyrighted material. This article was subject to blind, independent, expert peer review. The reviewers reported no competing interests.

References

1. Sherwin JC, Lewallen S, Courtright P. Blindness and visual impairment due to uncorrected refractive error in sub-Saharan Africa: review of recent population-based studies. *Br J Ophthalmol*. 2012;96(7):927–30.
2. Rabiu MM, Kyari F, Ezelum C, et al. Review of the publications of the Nigeria national blindness survey: methodology, prevalence, causes of blindness and visual impairment and outcome of cataract surgery. *Ann Afr Med*. 2012;11(3):125–30.
3. Yadav NK, Kemmanu V, Bhargava M, Shetty B. A truly knotless technique for scleral fixation of intraocular lenses: two-year results. *Indian J Ophthalmol*. 2012;60(2):147–8.
4. De Silva SR, Arun K, Anandan M, Glover N, Patel CK, Rosen P. Iris-claw intraocular lenses to correct aphakia in the absence of capsule support. *J Cataract Refract Surg*. 2011;37(9):1667–72.
5. Dick HB, Augustin AJ. Lens implant selection with absence of capsular support. *Curr Opin Ophthalmol*. 2001;12(1):47–57.
6. Kwon SW, Moon HS, Shyn KH. Visual improvement in high myopic amblyopic adult eyes following phakic anterior chamber intraocular lens implantation. *Korean J Ophthalmol*. 2006;20(2):87–92.
7. Akcay L, Eser I, Kaplan AT, Taskiran-Comez A, Dogan OK. Phakic anterior chamber lenses in very high myopia: an 18-month follow up. *Clin Experiment Ophthalmol*. 2012;40(3):275–81.
8. Cook CD, Evans JR, Johnson GJ. Is anterior chamber lens implantation after intracapsular cataract extraction safe in rural black patients in Africa? A pilot study in KwaZulu-Natal, South Africa. *Eye (Lond)*. 1998;12(Pt 5):821–5.
9. Baumeister M, Terzi E, Ekici Y, Kohnen T. Comparison of manual and automated methods to determine horizontal corneal diameter. *J Cataract Refract Surg*. 2004;30(2):374–80.
10. Omulecki W, Bartela J, Synder A, Pałenga-Pydyn D, Wilczyński M. Results of implantation a new type of foldable anterior chamber intraocular lens. *Klin Oczna*. 2011;113(7–9):216–22.
11. McAllister AS, Hirst LW. Visual outcomes and complications of scleral-fixated posterior chamber intraocular lenses. *J Cataract Refract Surg*. 2011;37(7):1263–9.
12. Bekibele CO. Anterior chamber intra-ocular lens surgery at Ago-Iwoye, Ogun State, Nigeria. *Niger Postgrad Med J*. 2002;9(3):134–6.
13. Gonnermann J, Klamann MK, Maier AK, et al. Visual outcome and complications after posterior iris-claw aphakic intraocular lens implantation. *J Cataract Refract Surg*. 2012;38(12):2139–43.
14. Rao R, Sasidharan A. Iris claw intraocular lens: a viable option in monocular surgical aphakia. *Indian J Ophthalmol*. 2013;61(2):74–5.