European Journal of Ophthalmology / Vol. 14 no. 1, 2004 / pp. 1-6

Small incision clear lens extraction for correction of high myopia

A. KUBALOĞLU, T. YAZICIOĞLU, S. TACER

Department of Ophthalmology, Kartal Education and Research Hospital, Istanbul - Turkey

PURPOSE. *To evaluate the effectiveness, predictability, and safety of clear lens extraction in the correction of high myopia.*
SETTING. *Kartal Education and Research Hospital, Istanbul, Turkey.*
METHODS. *This retrospective study comprised 56 eyes of 30 patients who had clear lens extraction to correct myopia of 12.00 diopters (D) or more. Small incision clear lens extraction using an anterior chamber maintainer was performed and low-power posterior chamber intraocular lens (IOL) was implanted. The mean postoperative follow-up was 40.2±11.9 months.*
RESULTS. *Uncorrected visual acuity improved in 94.6% of eyes. Best-corrected visual acuity (BCVA) improved in 37 eyes (66 %); 27 (48.2 %) gained two or more lines. The percentage of eyes achieving a BCVA of 20/40 or better increased from 26.7% preoperatively to 58.9% postoperatively. Of the eyes, 38 (67.8%) were within ±1.00 D of targeted refractive error and 52 (92.8%) were within ±2.00 D. Posterior capsule tear with vitreous loss occurred in one eye (1.7%). During the follow-up, retinal detachment (RD) occurred in 2 eyes (3.5%).*
CONCLUSIONS. *Clear lens extraction and IOL implantation was effective and had an acceptable predictability and a low morbidity in correcting high myopia. Regular retinal examination is necessary to prevent postoperative RD. (Eur J Ophthalmol 2004; 14: 1-6)*

KEY WORDS. *Clear lens extraction, Intraocular lens implantation, High myopia correction*

Accepted: October 29, 2003

INTRODUCTION

Removal of the crystalline lens for refractive reasons in highly myopic patients remains controversial. The myopic eye has always been considered to be at high surgical risk, not only because of the higher rate of intraoperative complications but also the increased risk of postoperative retinal detachment (RD) (1, 2).

Recent advances in phacoemulsification, small incision surgery, new intraocular lenses (IOL), and viscoelastics have reduced the complications in eyes with high myopia. Myopic correction with phacoemulsification and subsequent implantation of IOL has better results when compared to the other techniques (3-7). In addition, the developments in retinal examination and prophylactic laser treatment have been used successfully in patients with high myopia (8).

The manual, small incision exstracapsular cataract extraction with mini-nuc technique has proved to be a safe modern cataract surgery (9, 10). This procedure must be performed under positive intraocular pressure that exists 100% of the operating time. These conditions are constantly achieved by the anterior chamber maintainer, irrigating the eye and simultaneously controlling the positive intaocular pressure (10).

We performed small incision clear lensectomy us-

 1120-6721/001-06$15.00/0

ing anterior chamber maintainer and low power posterior chamber IOL implantation for correction of high myopia. In this retrospective clinical study, we evaluated the effectiveness, predictability, and safety of this surgical procedure.

MATERIALS AND METHODS

Between June 1996 and June 1998, 56 eyes of 30 patients had clear lensectomy with posterior chamber IOL implantation for high myopia. All surgery was performed by the same surgeon (A.K.). Surgery was bilateral in 26 patients. Four patients underwent planned bilateral simultaneous procedure. The patients' mean age was 42.63±9.99 years (range 27 to 60 years). The characteristics of patients are shown in Table I. Mean follow-up was 40.23±11.97 months (range 24 to 60 months). There were results for 24 patients (46 eyes) at 36 months, 17 patients (33 eyes) at 48 months, and 13 patients (24 eyes) at 60 months.

Patients were selected on the basis of preoperative myopia greater than 12 diopters (D) and a best-corrected visual acuity (BCVA) of 20/200 or better. Patients with higher than grade I nuclear sclerosis were not included in the study. Calculation of the IOL power was made using the Sanders & Retzlolf-Kraff II formula as it was included in our biometer (Teknar). The targeted postoperative refraction ranged from emetropia to -3.00 D depending on the patient's expectations. Exclusion criteria consisted of prior retinal break or detachment (even in the fellow eye), glaucoma, or previous surgery. A detailed informed consent was obtained from all patients for this procedure.

Preoperative and postoperative complete ophthalmologic examinations, including uncorrected visual acuity (UCVA) and BCVA, cycloplegic and manifest refractions, keratometry, biomicroscopy, tonometery, and indirect ophthalmoscopy, were performed. Three patients had focal argon laser treatment before clear lens extraction for retinal tears and hole. Postoperative evalutions were made at 1 day, 1 week, and at 1, 3, 6, 12, 18, 24, 36, 48, and 60 months.

Forty-eight of 56 procedures were performed using topical and low-dose perilimbal subconjunctival anesthesia. General anesthesia was used in four patients who underwent bilateral simultaneous surgery. The same surgical technique was used in all cases.

TABLE I - PATIENT DEMOGRAPHICS

Characteristic	Value
Number of patients	30
Bilateral cases	26
Unilateral cases	4
Sex	
female	19
male	11
Age, yr	
mean	42.63±11.97
range	27-60

TABLE II - PREOPERATIVE AND POSTOPERATIVE DATA

Data mean ± SD	Range
Spherical equivalent (D) -18.90±3.83	- 26.00 to -11.50
Axial length (mm) 30.59±1.74	26.90 to 34.60
Intraocular lens power (D) 3.73±3.51	0.00 to 11.00
Postoperative refraction (D) 1.14±1.35	-4.00 to 1.50
Follow-up (months) 40.23±11.97	24.00 to 60.00

After setting anterior chamber maintainer, a frown incision of length 6 mm was made 2 mm posterior to the limbus. Then, a scleral tunnel was created using a crescent knife. An anterior capsulorrhexis about 6.0 mm wide was made with a cystotome under positive hydrostatic pressure. Careful hydrodissection and hydrodelination of the lens nucleus were performed. All of the lens material was aspirated by a manual cortex extractor or soft nucleus and epinucleus were hydroexpressed out by slight pressure on the posterior lip of the scleral incision. The anterior and the posterior capsules were cleaned with a capsule polisher cannule. Because of the long time follow-up results were known, and also economic, a poly (methyl methacrylate) one-piece IOL with an optic diameter of 6.0 mm and haptic diameter of 12.5 mm (Balance,

TABLE III - PREOPERATIVE AND POSTOPERATIVE BEST-CORRECTED AND UNCORRECTED VISUAL ACUITIES

Corrected-uncorrected Snellen equivalent	Preoperative n (%)	Postoperative n (%)	Postoperative n (%)
20/20-20/40	15 (26.8)	33 (58.9)	15 (26.8)
20/50-20/100	36 (64.3)	20 (35.7)	36 (64.3)
20/200 or worse	5 (8.9)	3 (5.4)	5 (8.9)

Hanita) was implanted in the capsular bag. The scleral incision was closed with one or two interrupted 10.0 nylon sutures.

If simultaneous bilateral surgery was performed, the surgeon's gown and gloves were changed and a new irrigating solution and a separate set of surgical instruments were used. At the end of surgery, gentamycin and betamethasone were given subconjunctivally.

Postoperatively, patients were treated with a combination of tobramycin and dexamethasone drops for four weeks.

RESULTS

The mean preoperative spherical equivalent was -18.90±3.83 D (range -11.50 to -26.00 D) and the mean preoperative keratometer was 43.80±1.38 D (Tab. II). The mean axial length was 30.59 ± 1.74 mm (range 26.90 to 34.60 mm). The axial length was greater than 28 mm in 91.0% of eyes, greater than 30 mm in 64.2% of eyes, and greater than 32 mm in 21.4% of eyes. The mean IOL power was 3.73± 3.51 D (range 0 to 11 D). As these IOL had no minus power, 0 D IOL were implanted in 20 eyes (35.7%).

Intraoperatively, posterior capsule tear occurred in two eyes. One of them had vitreous loss and anterior vitrectomy was made with the anterior vitrectomy handpeice (Visitec) and IOL was implanted in the sulcus. Minimal posterior tear occurred in the other one during posterior capsular polishing. After viscoelastic injection, posterior capsulorrhexis was made and IOL was implanted in the bag.

The postoperative mean spherical equivalent was -1.14±1.35 D (range +1.5 to -4.0 D). A total of 55.3% of eyes were within ±I.0 D of targeted refraction and 85.7% of eyes were within ±2.00 D. Biometric error occured more than 2.00 D in four eyes, with a deviation of 4 D in one eye, of 3 D in two eyes, and of 2.50 D in one eye.

UCVA improved in 94.6% of eyes, with 89.2% of eyes achieving UCVA of 20/100 or better and 26.7% achieving 20/40 or better (Tab. III). BCVA improved in 66.0% of eyes. A total of 48.2% of eyes gained two or more lines. The percentage of eyes achieving of 20/40 or better BCVA inreased from 26.7% preoperatively to 58.9% postoperatively. BCVA remained the same in 28.5% of eyes; it decreased after surgery in three eyes (due to RD in two eyes and macular hemorhage in one eye).

The incidence of posterior vitreus detachement (PVD) was 51.8% (29 eyes).

During the second postoperative year, we observed two new cases, and two additional cases by the fifth year.

During the follow-up period, RD occurred in 2 eyes (3.5%). It was observed 4 weeks after surgery in the eye with posterior capsule rupture and vitreous loss. In the other eye, although there were no intraoperative complications, detachments was diagnosed two years after the surgery. Both patients were operated by pars plana vitrectomy successfully. BCVA on Snellen chart was decreased four lines in one patient and two lines in the other patient. Retinal laser prophylaxis was done in their fellow eyes. Twenty-four months after surgery, retinal tear was diagnosed in two eyes, which were successfully treated with laser photocoagulation.

Posterior capsule opacification that required Nd: YAG capsulotomy developed in 9 eyes (16%). Laser capsulotomy was performed 12 months postoperatively in two eyes, at 24 months in four eyes, and at 36 months

in three eyes. No complications were encountered as the result of the capsulotomy procedure.

Other postoperative complications we observed were subclinical IOL decentralization in one case and macular hemorrhage (due to subretinal neovascular membrane formation) in one case. In addition, two eyes of one patient had an intraocular pressure increase greater than 24 mm Hg that responded to medical treatment.

DISCUSSION

Two different refractive surgical techniques have been developed to correct high myopia: intraocular procedures and methods that change the corneal curvature. Corneal surgical procedures include radial keratotomy, keratomileusis, epikeratoplasty, photorefractive keratectomy, and laser *in situ* keratomileusis (11-14). The intraocular techniques comprise clear lens extraction with or without implantation of an IOL and negative IOL implantation in phakic eyes (2-5, 15-17).

Keratomileusis, epikeratophakia, and radial keratotomy are not performed anymore because of poor predictability, high residual postoperative refractive error, and high incidence of postoperative complications. At present, laser *in situ* keratomileusis is the most preferred excimer laser surgery. Its advantages over photorefractive keratectomy are faster visual rehabilitation, less patient discomfort, increased predictability, and reduced incidence of corneal haze and scar formation (18, 19). Howewer, the perceived quality of vision and contrast sensitivity were significantly less in high myopia and corneal ectasia may occur (20, 21).

Another approach in correction of high myopia is implantation of a negative anterior or posterior chamber IOL in phakic eyes, which provides stability of refractive correction with high predictability and reversibility. Anterior chamber phakic IOL has potential for damage to the anterior chamber structures, especially endothelial cell loss, chronic intraocular pressure elevation, and pupil ovalization (15). Although the implantation of posterior chamber phakic IOL in highly myopic eyes seems to have promising short-term results, the contact between iris-phakic IOL and crystalline lens-phakic IOL leads to pupillary block glaucoma, pigmentary dispersion syndrome, and cataract formation (16, 17, 22). Clear lens extraction with lens implantation in high myopia is as effective as phakic IOL implantation and has been performed with excellent refractive results. However, in addition to all the possible complications related to intraocular procedures, postoperative loss of accommodation constitutes a handicap for young patients.

In our study, 55.3% of eyes were within ±1.00 D of targeted refractive error and 85.7% within ±2.00 D. The refractive target was emmetropia or -3.0 D because of patient expectations. Four eyes developed a refractive error greater than 2.00 D, probably because of biometric errors (axial length measurement, inadequate formula). We used SRKII formula, which is more frequently referred to in the literature; however, it is not adequate in extremely long eyes (23). Comparing the results of this series with corneal reshaping techniques, the refractive outcomes of clear lens extraction are better in both predictability and stability. On the other hand, we preferred to treat patients with high myopia in prepresbyopic or in the presbyopic age to compensate for accommodation loss.

The major concern about clear lens extraction is RD, which previous studies have shown to occur more frequently in myopic eyes than normal eyes. Postoperative RD often occurs after 1 year and may not be directly related to surgery (24). Barraquer et al retrospectively analyzed the results of clear lens extraction performed with various surgical techniques (intracapsular extraction, extracapsular extraction with or without posterior chamber IOL implantation) in 165 eyes with high myopia (1). They found a 7.3% incidence of RD and RD occurred an average of 30.7 months (±26.6 months) after surgery. In a few series with phacoemulsification and posterior chamber IOL implantation RD was not observed but there was a small number of patients and the follow-up was probably too short (4, 5, 25). Colin et al reported a RD incidence of 1.9% 4 years and 8.1% 7 years after clear lens extraction (26).

During the 3-year follow-up, RD occurred in 2 eyes (3.5%) in our study. Preoperative prophylactic laser treatment was done only in 3 (5.3%) cases. In the first case, RD occurred in the eye that had an intraoperative posterior capsular tear. There is a clear correlation between posterior capsule tear and an increased risk of RD (7). In the second case, RD occurred 24 months after the surgery. Prophylactic argon laser treatment of degenerative lesions was done in the fellow eyes of these cases. The incidence of RD in our study

is similar with that of clear lens phacoemulsification. In a closed system surgery like ours, there is a continuously positive intraocular pressure provided via anterior chamber maintainer, which stabilizes the anterior segment and may result in minimal intraocular trauma to the vitreous and retina.

The incidence of PCO in our study is 16% and is similar to that reported in other series. Opening the posterior capsule in myopic eyes probably alters the vitreous gel and these vitreous changes may predispose the patient to retinal degeneration and RD (1, 27). We performed YAG-laser posterior capsulotomy without complications in our series. In addition, one eye developed subfoveal choroidal neovascularization but it is not obvious whether there is a potential increased risk of macular complication after clear lens extraction.

In conclusion, clear lens extraction is a cost-effective and safe procedure, with acceptable predictability, for correcting high myopia. The risk of postoperative RD is probably reduced with the manual, small incision extracapsular technique using anterior chamber maintainer. However, detailed retinal peripheral examination preoperatively and continuous follow-up is needed to avoid RD.

Reprint requests to:
Anıl Kubaloğlu, MD
Altıyol Kırtasiyeci Sok. No:36
Kat. 2 Kadıköy
Istanbul, Turkey
akubaloglu@e-kolay.net

REFERENCES

1. Barraquer C, Cavelier C, Mejia LF. Incidence of retinal detachment following clear-lens extraction in myopic patients: retrospective analysis. Arch Ophthalmol 1994; 112: 336-9.
2. Rodriguez A, Guttierrez E, Alvira G. Complications of clear lens extraction in axial myopia. Arch Ophthalmol 1987; 105: 1522-3.
3. Gris O, Guell JL, Manero F, Muller A. Clear lens extraction to correct high myopia. J Cataract Refract Surg 1996; 22: 686-9.
4. Jimenez-Alfaro I, Miguelez S, Bueno JL, Puy P. Clear lens extraction and implantation of negative-power posterior chamber intraocular lenses to correct extreme myopia. J Cataract Refract Surg 1998; 24: 1310-5.
5. Lee KH, Lee JH. Long-term results of clear lens extraction for severe myopia. J Cataract Refract Surg 1996; 22: 1411-4.
6. Pucci V, Morselli S, Romanelli F, Pignatto S, Scandellari F, Bellucci R. Clear lens phacoemulsification for correction of high myopia. J Cataract Refract Surg 2001; 27: 896-900.
7. Colin J, Robinet A. Clear lensectomy and implantation of low-power posterior chamber intraocular lens for the correction of high myopia. Ophthalmology 1994; 101: 107-12.
8. Blumenthal M, Ashkenazi I, Assai E, Cahone M. Small incision manual extracapsular cataract extraction using selective hydrodissection. Ophthalmic Surg 1992; 23: 699-701.
9. Wright M, Chawla H, Adams A. Results of small incision extracapsular cataract surgery using anterior chamber maintainer without viscoelastic. Br J Ophthalmol 1999; 83: 71-5.
10. Blumenthal M, Assia EI, Chan U, Avni I. Using anterior chamber maintainer to control intraocular pressure during phacoemulsification. J Cataract Refract Surg 1994; 20: 93-6.
11. Waring GO III, Lynn MJ, Gelender H, et al. Results of the Prospective Evaluation of Radial Keratotomy (PERK) study one year after surgery. Ophthalmology 1985; 92: 177-98.
12. Neumann AC, McCarty G, Sanders DR. Delayed regression of effect in myopic epikeratophakia vs keratomileusis for high myopia. J Refract Corneal Surg 1989; 5: 161-6.
13. Rogers CM, Lawless MA, Cohen PR. Photorefractive keratectomy for myopia of more than -10 diopters. J Refract Corneal Surg 1994; 10: 178-87.
14. Güell JL, Muller A. Laser *in situ* keratomileusis (LASIK) for myopia from -7 to -18 diopters. J Refract Surg 1996; 12: 222-8.
15. Baikoff G, Arne JL, Bakobza Y, et al. Angle-fixated anterior chamber phakic intraocular lens for myopia of -7 to -19 diopters. J Refract Surg 1998; 14: 282-93.
16. Jimenez-Alfaro I, Benitez del Castillo JM, Garcia- Feijoo J, Gil de Bernabe JG, Serrano de La Iglesia JM. Safety of posterior chamber phakic intraocular lenses for correction of high myopia: anterior segment changes after posterior chamber phakic intraocular lens implantation. Ophthalmology 2001; 108: 90-9.

17. Brandt JD, Mockovak ME, Chayet A. pigmentary dispersion syndrome induced by a posterior chamber phakic refractive lens. Am J Ophthalmol 2001; 131: 260-3.
18. Lyle WA, Jin GJC. Laser *in situ* keratomileusis with the VISX Star laser for myopia over -10.0 diopters. J Cataract Refract Surg 2001; 27: 1812-22.
19. Gimbel HV, Westenbrugge JA, Penno A, Ferensowicz M, Feinerman GA, Che R. Simultaneous bilateral laser *in situ* keratomileusis. Safety and efficacy. Ophthalmology 1999; 106: 1461-8.
20. Perez-Santonja J, Bellot J, Claramonte P, Ismail M, Alio JL. Laser *in situ* keratomileusis to correct high myopia. J Cataract Refract Surg 1997; 23: 372-85.
21. Pallikaris IG, Kymionis GD, Astyrakakis NI. Corneal ectasia induced by laser *in situ* keratomileusis. J Cataract Refract Surg 2001; 27: 1796-802.
22. Bylsma SS, Zalta AH, Foley E, Osher RH. Phakic posterior chamber intraocular lens papillary block. J Cataract Refract Surg 2002; 28: 2222-8.
23. Yalvaç IS, Nurözler A, Ünlü N, et al. Calculation of intraocular lens power with the SRK II formula for axial high myopia. Eur J Ophthalmol 1996; 6: 375-8.
24. Fan DS, Lam DSC, Li KKW. Retinal complications after cataract extraction in patients with high myopia. Ophthalmology 1999; 106: 688-91.
25. Kohnen S, Brauweiler P. First results of cataract surgery and implantation of negative power intraocular lenses in highly myopic eyes. J Cataract Refract Surg 1996; 22: 416-9.
26. Colin J, Robinet A, Cochener B. Retinal detachment after clear lens extraction for high myopia. Ophthalmology 1999; 106: 2281-4.
27. Nissen KR, Fuchs J, Goldschmidt E, et al. Retinal detachment after cataract extraction in myopic eyes. J Cataract Refract Surg 1998; 24: 772-6.