COMPARISON OF SMALL-INCISION PHACOEMULSIFICATION WITH STANDARD EXTRACAPSULAR CATARACT SURGERY: POST-OPERATIVE ASTIGMATISM AND VISUAL RECOVERY

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SUMMARY

A prospective study compared post-operative astigmatism and visual acuity (corrected and uncorrected) following phacoemulsification and extracapsular surgery. Fifty eyes had implantation of a 7 mm diameter optic intraocular lens (IOL) following conventional extracapsular cataract extraction (ECCE) with a 10 mm corneal incision. Forty-seven eyes were implanted with a 5×6 mm optic IOL through a 5 mm scleral incision after phacoemulsification. Uncorrected visual acuity of 6/9 or better was achieved in 25% of eyes on the first day following phacoemulsification, 36% at 1 week and 57% at 12 weeks. These results (and also the best corrected acuity) were significantly better than those following ECCE. Less astigmatism was induced by phacoemulsification than extracapsular surgery, measured at all post-operative time intervals.

Small-incision phacoemulsification has the potential to reduce post-operative astigmatism and hasten visual rehabilitation of patients when compared with conventional extracapsular cataract extraction (ECCE).[1–3] We performed a prospective study of patients having cataract surgery who were arbitrarily assigned to undergo either small-incision phacoemulsification or conventional ECCE.

PATIENTS AND METHODS

Patients (Eyes)

The patients recruited for this study had functional visual disability fully accounted for by cataract formation and no other ocular pathology. The intended post-operative refractive error for all study eyes was −0.5 dioptres (D) in spherical equivalence. Eyes with pathology detected post-operatively were excluded from the study. Only one eye per patient was included in the study.

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All the study patients were examined at 1 day, 1 week and 12 weeks following intraocular lens (IOL) implantation. The parameters evaluated were uncorrected and corrected visual acuity using a Snellen chart at 1 day, 1 week and 12 weeks post-operatively and keratometric cylinder pre-operatively and at 1 week and 12 weeks post-operatively.

Surgical Technique

Conventional Extracapsular Surgery. A 10 mm corneal incision was made and sodium hyaluronate injected into the anterior chamber. Following a 'beer can' anterior capsulotomy the nucleus was expressed using a bimanual technique, avoiding any direct pressure on the cornea. Cortical material was aspirated manually using a 5 ml syringe and two-way Pearce cannula. The irrigating solution used was balanced salt. The 7 mm optic one-piece polymethylmethacrylate (PMMA) IOL was implanted under sodium hyaluronate. The wound was closed with five interrupted 10.0 nylon sutures and all the sodium hyaluronate was aspirated from the anterior chamber.

Phacoemulsification Surgery. A 5 mm three-stage self-sealing sclera-to-cornea tunnel incision was made, beginning 2.5 mm from the limbus. Sodium hyaluronate was injected into the anterior chamber. A continuous curvilinear capsulorrhexis was made approximately 5 mm in diameter. Hydrodissection of the lens was performed. The nucleus was phacoemulsified using low flow/high vacuum settings and a four-segment nuclear 'cracking' technique within the capsular bag. Cortical material was mechanically aspirated with balanced salt as the irrigating solution. The capsular bag was filled with sodium hyaluronate and a 5×6 mm optic, 12.5 mm haptic one-piece PMMA IOL implanted into the bag. The sodium hyaluronate was aspirated from the anterior chamber and the wound closed with a single 10.0 nylon cross-stitch.

Betamethasone 4 mg and cephradine 125 mg were

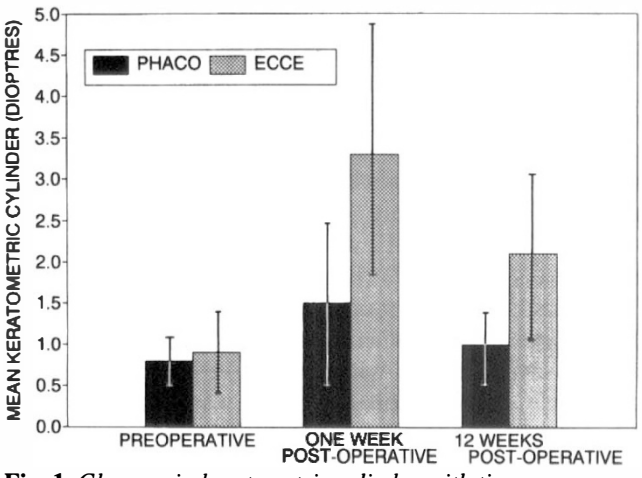

Fig. 1. *Changes in keratometric cylinder with time.*

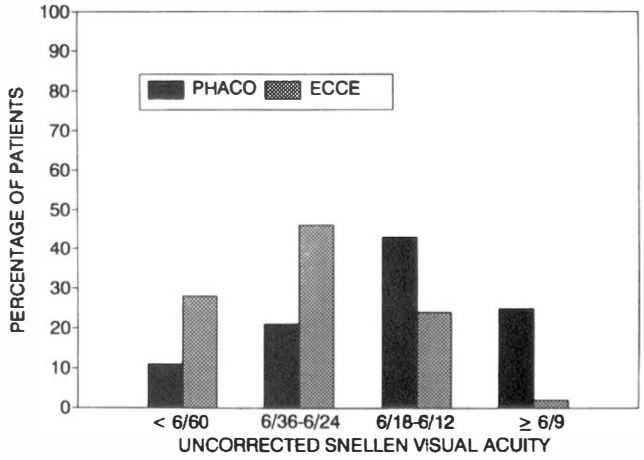

Fig. 2. *Distribution of uncorrected visual acuity 1 day post-operatively.*

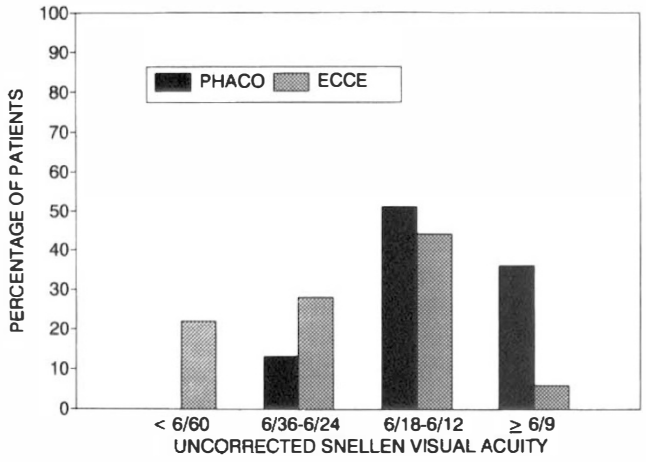

Fig. 3. *Distribution of uncorrected visual acuity 1 week post-operatively.*

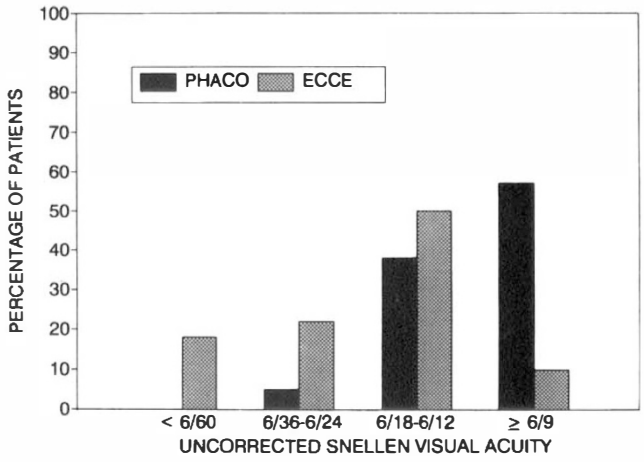

Fig. 4. *Distribution of uncorrected visual acuity 12 weeks post-operatively.*

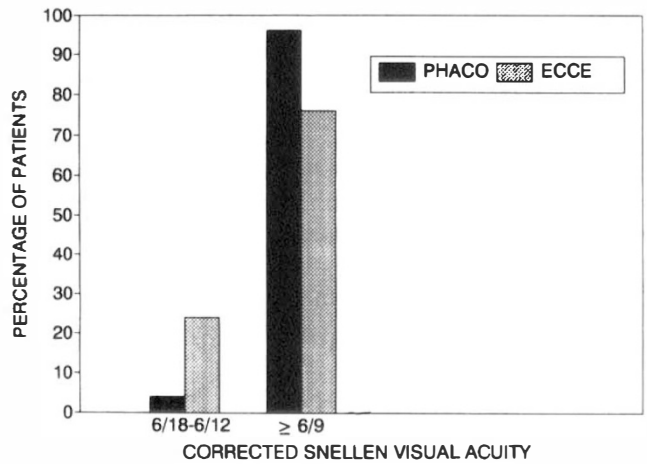

Fig. 5. *Distribution of corrected visual acuity 1 day post-operatively.*

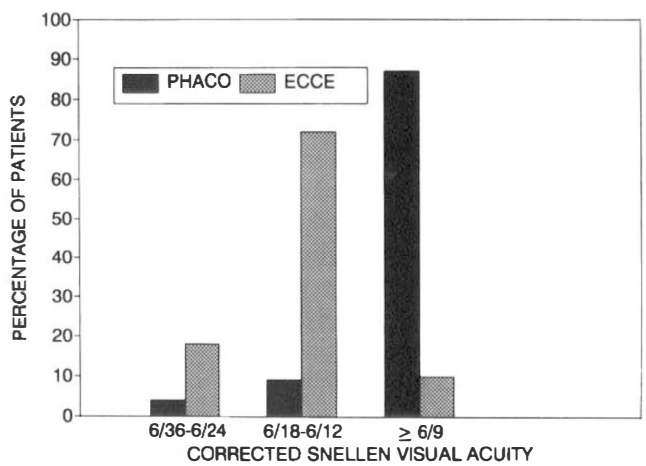

Fig. 6. *Distribution of corrected visual acuity 1 week post-operatively.*

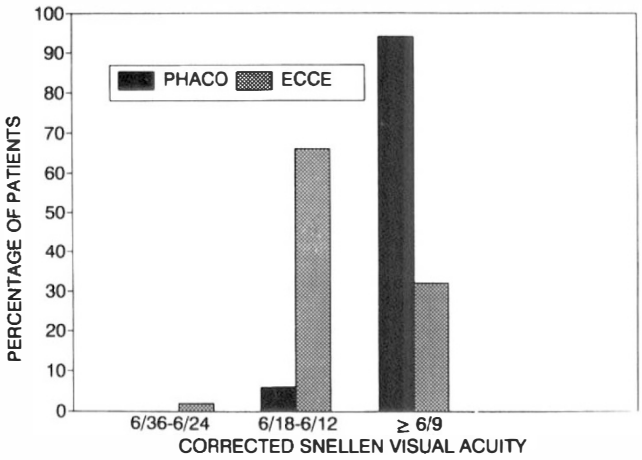

Fig. 7. *Distribution of corrected visual acuity 12 weeks post-operatively.*

injected subconjunctivally at the conclusion of every operation. A combination of betamethasone and neomycin eyedrops was used four times daily for 1 week and twice daily for up to four weeks post-operatively.

Statistical Analysis

The Student's independent *t*-test was used to estimate the statistical significance of the difference in the mean age of the patients in the two study groups.

The analysis of variance (ANOVA) was used to assess the statistical significance of intra-group and inter-group differences in mean keratometric cylinder at various measured post-operative time intervals.

The chi-squared test with Yates' correction for continuity was used to assess the statistical significance of the difference between the two study groups in the number of eyes (a) with a keratometric cylinder of ≤2.0 D at baseline and at various post-operative time intervals, and (b) with an uncorrected and corrected visual acuity respectively of ≥6/9 at various post-operative time intervals.

RESULTS

Ninety-seven patients (eyes) met the inclusion and exclusion criteria, of whom 47 had undergone small-incision phacoemulsification and 50 conventional ECCE. The mean age of the patients in the conventional ECCE group, 76 (SD 7.2) years, was similar ($p > 0.1$) to the mean age of 74 (SD 5.7) years in the phacoemulsification group.

Corneal astigmatism was similar in the two groups prior to surgery ($p > 0.2$). The number of eyes with astigmatism ≤2.0 D in keratometric cylinder was significantly greater in the phacoemulsification group than in the conventional ECCE group at 1 week ($p \ll 0.001$) and 12 weeks ($p \ll 0.001$) post-operatively. The mean keratometric cylinder, which was similar in the two groups pre-operatively ($p > 0.1$), was significantly less in the phacoemulsification group than in the conventional ECCE group at 1 week ($p << 0.001$) and 12 weeks ($p \ll 0.001$) following surgery (Fig. 1). In spite of the reduction in post-operative corneal astigmatism with time in both the study groups, mean keratometric cylinder measurements in eyes which had undergone conventional ECCE were significantly more than pre-operative values at 1 week ($p \ll 0.001$) and 12 weeks ($p \ll 0.001$) post-operatively (Fig. 1). In the phacoemulsification group, mean keratometric cylinder values were significantly more than pre-operative values only at 1 week post-operatively ($p < 0.0001$) and by 12 weeks had returned to pre-operative levels ($p > 0.07$) (Fig. 1). None of the eyes in the phacoemulsification group required removal of sutures for high corneal astigmatism (≥2.5 D) at 12 weeks post-operatively, compared with 16 (32%) eyes in the conventional ECCE group; this difference was statistically significant (chi-squared test; $p \ll 0.001$).

There were significantly more patients with both uncorrected visual acuities (Fig. 2, $p < 0.005$; Fig. 3, $p < 0.001$; Fig. 4, $p \ll 0.001$) and corrected visual acuities (Figs. 5, 6 and 7, $p \ll 0.001$) of at least 6/9 in the phacoemulsification group than in the conventional ECCE group at all measured post-operative review periods.

DISCUSSION

The patients who underwent phacoemulsification in this study had less early post-operative corneal astigmatism than those who had conventional ECCE through a corneal incision. Also, by 12 weeks post-operatively the mean corneal astigmatism in the phacoemulsification group was similar to pre-operative measurements while it was significantly higher in the conventional ECCE group. These differences were reflected in the significantly higher number of eyes in the conventional ECCE group requiring removal of sutures for excessive induced astigmatism. The lower post-operative corneal astigmatism observed in the phacoemulsification group was most probably due to the scleral site and smaller size of the incision.[2–4]

It was found that patients who underwent phacoemulsification experienced faster visual recovery than those who had conventional ECCE. This may be due to the lower post-operative astigmatism in the phacoemulsification group. Previous investigators[3,4] have found that uncorrected visual acuity after cataract surgery recovered more quickly with a smaller incision, but this difference was largely obscured by correction of refractive error. In our patients, however, both uncorrected and corrected visual acuity recovered more quickly with phacoemulsification than with conventional ECCE. The benefit to a patient of visual acuity recovery in the early post-operative period depends mainly on uncorrected visual acuity because optical correction is generally not provided in the first 2–3 months following IOL implantation. This study indicates that small-incision phacoemulsification results in lower post-operative astigmatism and earlier recovery of visual function than that obtained with conventional ECCE using a corneal incision.

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Key words: Astigmatism, Extracapsular cataract surgery, Intraocular lens, Keratometric cylinder, Phacoemulsification, Small-incision cataract surgery, Visual acuity.

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