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# Intraocular pressure changes after clear corneal phacoemulsification in nonglaucomatous pseudoexfoliation syndrome

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PURPOSE. *To present a prospective, nonrandomized study of intraocular pressure (IOP) after clear corneal phacoemulsification in eyes with pseudoexfoliation (PEX) syndrome.*
METHODS. *A PEX group of 39 consecutive open angle, nonglaucomatous eyes with cataract in PEX syndrome, and a control group of 40 consecutive open angle, nonglaucomatous eyes with cataract, were operated on by the same surgeon (D.J.C.), using a standard phaco technique along with bimanual anterior epithelial cells aspiration and, in the PEX group, a bimanual anterior capsule PEX material aspiration. The mean diurnal Goldmann tonometer IOP was calculated preoperatively, after 3 and 6 months and 1 year.*
RESULTS. *The PEX group preoperative mean IOP was 18.3 mmHg, with a maximum of 24 and a minimum of 11 mmHg. Three months postoperatively a mean IOP change of -3.7 mmHg was found ($p<0.0001$), with a maximum IOP change of -10 mmHg. Six months and 1 year postoperatively the mean IOP change was -3.7 ($p<0.0001$) and -3.5 mmHg ($p<0.0001$), respectively. The control group preoperative mean IOP was 13.9 mmHg, with a maximum of 18 and a minimum of 10 mmHg. Three months postoperatively a mean IOP change of -0.9 mmHg was found ($p=0.028$), with a maximum IOP change of -3 mmHg. Six months and 1 year postoperatively the mean IOP change was -1.4 ($p<0.001$) and -0.48 mmHg ($p=0.11$), respectively.*
CONCLUSIONS. *Phacoemulsification with anterior capsule PEX material aspiration significantly reduced the mean diurnal IOP in the PEX group lasting 1 year postoperatively. (Eur J Ophthalmol 2008; 18: 77-81)*

KEY WORDS. *Pseudoexfoliative material aspiration, Pseudoexfoliation syndrome, Intraocular pressure, Clear corneal phacoemulsification*

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## INTRODUCTION

The ocular component of pseudoexfoliation (PEX) syndrome is the clinically evident aspect of a systemic elastic tissue disease (1).
PEX occurs mainly in older people with an incidence of 8% to 35% of patients over 70 years of age and is clinically bilateral in almost 50% of cases and histologically bilateral in 100% of cases (2).
At biomicroscopy PEX is diagnosed by the presence of grayish fibrillar-granular flakes on the anterior lens capsule and on the pupillary border of the iris (3).
Additional signs are iris depigmentation, stromal iris atrophy, pigment liberation after pupil dilation, melanin granules, and PEX material deposition on the trabeculum.
The PEX syndrome associates with ocular hypertension in approximately 12% of cases and with glaucoma in 8% of cases (4).
The causes of the glaucoma are hypothetical, with the more accredited as follows:

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– Trabecular meshwork engulfing by the PEX material
– Degeneration of the iris pigment epithelium with subsequent pigment deposition in the anterior chamber angle resembling that of the pigment dispersion syndrome
– Marked and site-specific elastosis in the lamina cribrosa (5).

In the literature are a large number of studies on the PEX syndrome in PEX glaucomatous eyes (6-8). The trabecular aspiration technique in PEX glaucomatous eyes was presented in 1994–1995, and correlated with a marked reduction in intraocular pressure (IOP) (9-12). A small number of studies is devoted to nonglaucomatous PEX eyes (13, 14).

The effect of phacoemulsification on the IOP is controversial (15-18). The present study analyzes the IOP changes after phacoemulsification in nonglaucomatous PEX eyes versus normal eyes.

## METHODS

### *Patients*

Starting in December 2002 and ending in December 2005, all the patients presenting to our center and scheduled for cataract surgery were evaluated for the enrollment.

The inclusion criteria were the presence of a cataract, open angle, and the absence of disc and visual field glaucomatous changes. In the bilateral cases only one eye was randomly included.

The exclusion general criteria were the presence or history of other intraocular diseases affecting the IOP like uveitis, herpetic keratitis, ocular trauma, previous filtering or cyclodestructive procedures, a narrow angle, previous argon laser trabeculoplasty or YAG laser iridotomy, or the use of a glaucoma therapy.

The exclusion surgical criteria were the addition of iris surgery or the occurrence of surgical complications.

A total of 79 eyes of 79 patients were enrolled in the study, 39 eyes in the PEX group and 40 eyes in the control group.

In the PEX group the mean age of 19 women and 20 men was 75.8 years, ranging from 54 years to 86 years, whereas in the control group the mean age of 21 women and 19 men was 71.9 years, ranging from 45 to 90 years.

In the PEX group the mean axial length was 23.52 mm, ranging from 21.92 mm to 26.70 mm, and the mean anterior chamber depth (ACD) was 3.26 mm, ranging from 2.72 mm to 4.05 mm. In the control group the mean axial length was 23.93 mm, ranging from 21.70 mm to 27.10 mm, and the mean ACD was 3.29 mm, ranging from 2.58 mm to 4.32 mm.

### *Surgical technique*

All eyes were dilated using cyclopentolate 1%, tropicamide 1%, and phenylephrine 2.5%.

Topical and sub-Tenon anesthesia were used in all cases.

All eyes had standard clear corneal phacoemulsification and intraocular lens (IOL) in the bag implantation on an outpatient basis performed by one surgeon (D.J.C.).

In the PEX group after the bimanual I/A phase and prior to the implantation of the IOL, a complete anterior capsule PEX material aspiration was performed.

Hydration of the incisions and intracameral injection of vancomycin concluded the procedure.

A capsular tension ring (CTR) was implanted in seven eyes of the PEX group.

No intraoperative or postoperative complications occurred. No patients were lost to follow-up.

Surgery was done using a 2.85 mm clear corneal temporal incision and two 1.0 mm paracentesis 90° to the phaco incision, superiorly and inferiorly. A capsulorhexis was created under sodium hyaluronate 3%–chondroitin sulphate 4% (Viscoat®) by a Inamura capsulorhexis forceps (Duckworth & Kent, England), followed by hydrodissection and bimanual phacoemulsification using the stop and chop technique in all cases. The cortex was removed by bimanual I/A. In all eyes a thorough anterior epithelial cells aspiration was performed along with a complete posterior capsule cleaning and, in the PEX group, an anterior capsule PEX material aspiration was added.

### *Anterior epithelial cells aspiration*

In both groups a complete bimanual anterior epithelial cells aspiration was performed in order to reduce the postoperative capsular contraction. A standard 0.3 mm port I/A probe was utilized, the bottle height was 78 cm, the flow rate 14 mL/min under continuous irrigation, and the maximum vacuum preset 10 mmHg. The aspiration of the anterior equatorial cells was attempted in all eyes, although in the majority of cases lacked the control of the completeness of the epithelial removal because of the scarce mydriasis.

### *Anterior capsule PEX material aspiration*

A 25 G curved silicone tip cannula (Visitec) was passed over the anterior surface of the anterior capsule. The bottle height and the phaco machine settings were the same as in the previous phase.

### *Posterior capsule cleaning*

At the last, using the same instruments and phaco machine settings, a thorough cleaning of the posterior capsule was performed.

### *CTR*

In seven eyes of the PEX group a 10 mm capsular tension ring (Moercher) was inserted by a bimanual technique, in five eyes just prior to the IOL implantation and in two eyes prior to the anterior epithelial cells aspiration, because of the capsular laxity.

### *IOL*

In all eyes a single piece AcrySof (Alcon) lens was implanted in the bag using a Monarch II injector (Alcon) and a C cartridge.

### *Postoperative therapy*

Immediately after the surgery a dexamethasone–tobramycin combination ointment was applied over the cornea and the palpebral margins. Four hours postoperatively the patients were instructed to start the topical therapy with dexamethasone–tobramycin combination drops QID.
The programmed controls were at day 1 and 4, then 1 week, 1 month, 3 months, 6 months, and 1 year postoperatively.

### *Measures*

The mean diurnal Goldmann tonometer IOP was calculated as the mean value of five measurements, taken 2 hours apart, the day of the preoperative visit, after 3 and 6 months, and after 1 year and corrected in function of the pachymetry.
The IOP values were corrected in relation to the central corneal thickness (CCT), measured 10 minutes prior to the first Goldmann tonometry, by a solid probe US pachymetry.
The differences between preoperative and postoperative values in each group were statistically analyzed by a paired *t*-test.

**TABLE I -** PSEUDOEXFOLIATION GROUP

| | **Mean IOP mmHg** | **IOP change mmHg** | **%** | **p values** |
|---|---|---|---|---|
| Preoperatively | 18.3 | | | |
| 3 months postoperatively | 14.6 | –3.7 | –20.2 | <0.0001 |
| 6 months postoperatively | 14.6 | –3.7 | –20.2 | <0.0001 |
| 1 year postoperatively | 14.8 | –3.5 | –19.1 | <0.0001 |

IOP = Intraocular pressure

**TABLE II -** CONTROL GROUP

| | **Mean IOP mmHg** | **IOP change mmHg** | **%** | **p values** |
|---|---|---|---|---|
| Preoperatively | 13.9 | | | |
| 3 months postoperatively | 13 | –0.9 | –6.5 | 0.02 |
| 6 months postoperatively | 12.5 | –1.4 | –10 | <0.001 |
| 1 year postoperatively | 13.4 | –0.5 | –3.6 | 0.11 |

IOP = Intraocular pressure

## RESULTS

In Tables I and II are presented the mean preoperative IOP and the IOP changes 3 and 6 months and 1 year postoperatively along with the p values in the PEX and the control group respectively.

The PEX group mean preoperative IOP was 18.3 mmHg with a maximum of 24 and a minimum of 11 mmHg (Tab. I).

Three months postoperatively the mean IOP was 14.6 mmHg with a maximum of 18 mmHg and a minimum of 10 mmHg. The mean IOP change was –3.7 mmHg, i.e., –20.2% ($p < 0.0001$), with a maximum change of –10 mmHg and one case with an elevation of 1 mmHg.

Six months postoperatively the mean IOP was almost the same, 14.6 mmHg, with a maximum of 18 mmHg and a minimum of 10 mmHg. The mean change was –3.7 mmHg, i.e., –20.2% ($p < 0.0001$), with a maximum change of –12 mmHg and two cases with an elevation of 1 mmHg.

One year postoperatively the mean IOP was 14.8 mmHg with a maximum of 19 and a minimum of 10 mmHg. The mean reduction was –3.5 mmHg, i.e., –19.1% ($p < 0.0001$) with a maximum IOP change of –12 mmHg and one case presenting an elevation of 2 mmHg.

In all eyes no glaucoma therapy was started postoperatively.

The control group mean preoperative IOP was 13.9 mmHg with a maximum of 18 and a minimum of 10 mmHg (Tab. II).

Three months postoperatively the mean IOP was 13 mmHg with a maximum of 20 mmHg and a minimum of 7 mmHg. The mean IOP change was –0.9 mmHg, i.e., –6.5% ($p = 0.02$), with a maximum reduction of –6 mmHg and 11 cases with an elevation of the mean IOP, ranging from 1 to 3 mmHg.

Six months postoperatively the mean IOP was 12.5 mmHg, with a maximum of 18 mmHg and a minimum of 7 mmHg. The mean change was –1.4 mmHg, i.e., –10% ($p < 0.001$), with a maximum reduction of –5 mmHg and six cases with an elevation of IOP ranging from 1 to 4 mmHg.

At 1 year the mean IOP was 13.4 mmHg with a maximum of 18 mmHg and a minimum of 10 mmHg. The mean reduction was –0.5 mmHg, i.e., –3.6% ($p = 0.11$) with a maximum reduction of –6 mmHg and 12 cases presenting an elevation of the IOP ranging from 1 to 3 mmHg.

In all eyes no glaucoma therapy was started postoperatively.

## DISCUSSION

The pseudoexfoliation syndrome is frequently associated with elevated IOP, open angle glaucoma, and cataract.

Cataract extraction alone can lower the IOP, but in general, the long-term effect of phacoemulsification on outflow facility is negligible.

In the literature, the IOP changes after a standard phacoemulsification procedure in normal eyes are controversial (15-18).

Pohjalainen et al in nonglaucomatous eyes found little mean IOP differences between the PEX group and the control group, with a mean of 3.8 mmHg IOP reduction 1 year postoperatively (14).

Shingleton et al in normal eyes found a 1 year postoperative mean IOP reduction of about 2 mmHg (15).

Wirbelauer et al, 6 months postoperatively, found no significant IOP differences between PEX patients and normal patients after phacoemulsification and self-sealing 7 mm scleral tunnel incision, both groups presenting a mean reduction of about 3 mmHg (13).

In the present study the mean IOP postoperative change in normal cases only was a reduction of 0.5 mmHg in contrast with the 3.5 mmHg in PEX nonglaucomatous eyes 1 year postoperatively.

Jacobi et al found that direct aspiration of pigment, cellular debris, and pseudoexfoliation material from the trabecular meshwork combined with cataract extraction decreased IOP for 2 years postoperatively in PEX glaucoma patients. It was evident that the eyes presenting higher preoperative IOP resulted in greater reduction (9-12).

In our study we demonstrate that a statistically significant reduction also is present in nonglaucomatous PEX eyes 1 year postoperatively, but not in the control group.

In the nonglaucomatous PEX syndrome eyes about a 20% mean IOP reduction is found 1 year postoperatively. This value is statistically significant in contrast to the 3.6% 1 year postoperative reduction found in the control group.

It is unclear why IOP reduction is stronger in the PEX group than in POAG eyes. One reason may be the PEX material aspiration; another may be a different effect of phaco technique on the PEX eyes.

The standard phaco technique creates a trabecular washout. The increased I/A time, because of the anterior epithelial cells aspiration and the anterior capsule PEX material aspiration, can enhance the washout effect.

Considering the possibility of a glaucomatous change in normotensive fellow eyes in patients with unilateral

glaucomatous PEX syndrome (19, 20), we conclude that the IOP reduction, realized by phacoemulsification as we performed it, with anterior epithelial cells and anterior capsule PEX material aspiration, can be of clinical relevance in reducing the glaucomatous risk in PEX nonglaucomatous eyes.

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