Effect of primary posterior continuous curvilinear capsulorhexis with and without posterior optic buttonholing on postoperative anterior chamber flare

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PURPOSE: To evaluate the effect of primary posterior continuous curvilinear capsulorhexis (PCCC) with and without posterior optic buttonholing (POBH) on the anterior chamber reaction after small-incision cataract surgery.

SETTING: Department of Ophthalmology, Medical University of Vienna, Vienna, Austria.

METHODS: Consecutive patients with age-related cataract having cataract surgery in both eyes under topical anesthesia were prospectively enrolled in a randomized clinical trial. In randomized order, cataract surgery with combined primary PCCC and POBH was performed in 1 eye; in the other eye, cataract surgery was performed with primary PCCC and in-the-bag implantation of an intraocular lens. Intraocular flare was measured with an FC-1000 laser flare–cell meter preoperatively and postoperatively at 1, 4 to 6, and 24 hours, 1 week, and 1 month.

RESULTS: Thirty patients (60 eyes) were evaluated. The peak of intraocular flare was 1 hour postoperatively in all study eyes. In both groups, the response steadily decreased thereafter. Anterior chamber flare was statistically significantly higher in eyes with primary PCCC without POBH than in eyes with combined primary PCCC–POBH at all postoperative testing points ($P<.001$), including at 1 month ($P = .01$).

CONCLUSIONS: Cataract surgery with combined primary PCCC–POBH led to significantly lower postoperative anterior chamber reaction than conventional in-the-bag implantation during a 4-week follow-up. The tight capsule–optic diaphragm effectively prevented the ophthalmic viscosurgical device captured behind the optic from entering the anterior chamber postoperatively.

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Primary posterior continuous curvilinear capsulorhexis (primary PCCC) has been used to prevent posterior capsule opacification (PCO)[1–6] based on the theory that removing the scaffold for the migration of lens epithelial cells (LECs) will provide a permanently clear optical zone. However, the primary PCCC creates an aperture between the anterior and posterior chambers of the eye. This may result in postoperative peaks of intraocular pressure (IOP) as well as an increased postoperative anterior chamber reaction.[7,8]

Combining a primary PCCC with posterior optic buttonholing (POBH) of the intraocular lens (IOL) may be an interesting alternative and has been investigated as a standard cataract procedure to completely prevent PCO formation in patients with age-related cataract.[9,10] A primary PCCC approximately 4.5 to 5.0 mm in diameter is created after standard cataract removal by phacoemulsification. Then, the optic of a 3-piece IOL is buttonholed posteriorly.

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Previous studies of inflammation after cataract surgery with a solitary primary PCCC without POBH found that postoperative flare intensity was not significantly different from postoperative flare measurements after conventional cataract surgery with in-the-bag IOL implantation.[11] No increase in postoperative anterior chamber reaction was observed after combined primary PCCC–POBH cataract surgery compared with after cataract surgery with in-the-bag IOL implantation.[8] Moreover, the IOL–capsule diaphragm effectively prevented the possibility of a residual ophthalmic viscosurgical device (OVD) bolus captured behind the IOL from accessing the anterior chamber in the first postoperative hours.[12] In case of a solitary primary PCCC, this retrolental OVD bolus may access the anterior chamber.[7]

The present study was designed to evaluate and compare the postoperative anterior chamber reaction after cataract surgery with primary PCCC with and without POBH.

PATIENTS AND METHODS

In this prospective clinical study, consecutive patients with age-related cataract awaiting bilateral same-day cataract surgeries were enrolled prospectively. Patients with a history of intraocular surgery, eye trauma, primary or secondary glaucoma, ocular hypertension (IOP >22 mm Hg), or uveitis were excluded from the study. The Ethics Committee of the Medical University of Vienna approved the study protocol. In accordance with the Declaration of Helsinki, informed consent was obtained.

Surgical Technique

In randomized order, cataract surgery with combined primary PCCC and POBH was performed in 1 eye; in the patients' other eye, cataract surgery was performed with primary PCCC and in-the-bag IOL implantation. The sequence of right eyes and left eyes was randomized, as was the sequence of surgical procedures (ie, whether combined primary PCCC–POBH or primary PCCC with in-the-bag IOL implantation was performed first).

Initial Steps, Both Groups One to 2 hours before the surgeries, diclofenac, phenylephrine 2.5%, tropicamide 0.5%, and cyclopentolate 1% eyedrops were administered. The same experienced surgeon (R.M.) performed all surgeries using topical anesthesia of oxybuprocaine and lidocaine 4% drops and an intracameral bolus of lidocaine 1% solution.

In all eyes, a temporal 3.0 mm posterior limbal incision and 2 paracenteses were created. Hydroxypropyl methylcellulose 2% (MedioClear) was used as a dispersive OVD for endothelial protection during phacoemulsification and sodium hyaluronate 1% (Healon), as a cohesive OVD for IOL implantation and primary PCCC–POBH maneuvers. Anterior capsulorhexis, hydrodissection, and phacoemulsification of the nucleus were followed by aspiration of the cortical remnants and cleaning of the capsular bag.

A well-centered 5.0 mm anterior CCC was created with a bent needle inserted through a paracentesis. After phacoemulsification of the nucleus, the residual cortex was removed by coaxial and bimanual irrigation/aspiration (I/A), the latter through an additional paracentesis opposite the main incision for thorough cleanup of subincisional remnants, if necessary. Residual lens fibers were meticulously peeled from the peripheral posterior capsule by vacuuming the capsule (lens-fiber peeling). The anterior capsule was left unpolished because this additional surgical maneuver might have biased the statistical analysis by influencing postoperative anterior chamber flare.

Primary Posterior Continuous Curvilinear Capsulorhexis

Before the anterior chamber was filled with OVD, a jet of a balanced salt solution was directed through the zonules to separate the anterior hyaloid membrane from the posterior capsule. Then, a medium-viscosity OVD (sodium hyaluronate 1%, 10 mg/mL) was injected as follows: The remaining peripheral anterior capsule was pushed back toward the flattened posterior capsule, collapsing the capsular bag periphery and creating 1 uniform horizontal capsule diaphragm. Following the outlines of the anterior capsulorhexis, a well-centered primary PCCC with a target diameter of 4.5 mm was created as follows: With the tip of a 30-gauge hypodermic needle inserted through the lateral paracentesis, the central posterior capsule was approached at a flat angle with a needle and then perforated. The resulting capsule incision was extended sideward, and the distal edge was lifted. The flap thus formed was then grasped; the tear was extended radially and then tangentially until the intended primary PCCC radius was attained.

At this stage of surgery, the anterior hyaloid membrane was separated from the remaining peripheral posterior capsule by gently injecting OVD into Berger space. Then, the primary PCCC was completed by 2 to 3 consecutive grasps with the forceps. If necessary, additional OVD boluses were added between the grasps for safe separation of the posterior capsule and anterior hyaloid membrane.

Primary Posterior Continuous Curvilinear Capsulorhexis with Posterior Optic Buttonholing After the central capsule portion was removed from the eye, the OVD was gently injected beneath the peripheral ring of the residual posterior capsule to separate it from the underlying vitreous surface and lift it up toward the anterior capsule. When this was completed along the entire circumference, the anterior segment was prepared for the implantation of a foldable 3-piece IOL (AF-1 YA-60BB, Hoya). The central chamber was deepened. The capsular fornix to the surgeon's left expanded and was thus prepared to take up the tip of the leading IOL haptic, which was guided into the capsular bag fornix; the tip of the haptic was then followed by the optic and trailing haptic. By gently pressing on the optic with 2 phaco spatulas at a time to avoid excessive tilt, the optic was finally enclavated in the primary PCCC. The OVD was then gently aspirated from the anterior chamber and capsular bag fornix with the pump set at 7 mL/min and 100 mm Hg. As the posterior capsule was firmly pressed into the anterior optic surface, the optic–capsule diaphragm hermetically sealed off the posterior segment; no OVD was allowed to access the anterior chamber from the retrolental space during this maneuver.

Primary Posterior Continuous Curvilinear Capsulorhexis with In-the-Bag Implantation After creation of a well-centered primary PCCC, the capsular bag was filled and expanded with the medium-viscosity OVD. Then, the IOL