

Capsular tension ring for zonular dehiscence in combined phacoemulsification and pars plana vitrectomy with or without gas tamponade

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Abstract

We report the use of a capsular tension ring in 2 patients with zonular dehiscence who underwent combined phacoemulsification and pars plana vitrectomy with or without gas tamponade. In both cases, insertion of a capsular tension ring stabilized the capsular bag for phacoemulsification and allowed implantation of the foldable intraocular lens within the capsular bag. Intraoperatively, in one patient a small amount of air escaped into the anterior chamber, for which the capsular tension ring was gently massaged to reposition and expel the air. No air escaped into the anterior chamber in the other case. Postoperatively, the intraocular lens and capsular complex remained stable. Our cases showed that a capsular tension ring may be a surgical option for managing patients with limited zonular dehiscence and involves combining phacoemulsification with pars plana vitrectomy.

Key words: Cataract extraction; Lens capsule, crystalline; Lens implantation, intraocular; Phacoemulsification; Vitrectomy

Introduction

The capsular tension ring (CTR) is a relatively new device, which allows safe phacoemulsification in eyes with zonular

dehiscence.¹⁻⁹ Placement of the CTR extends the collapsed capsular bag equator and restores the normal lens equator-ciliary process anatomy. Since zonular dehiscence is occasionally present in patients undergoing combined phacoemulsification and pars plana vitrectomy, insertion of CTR may be a useful option in managing these cases. In many instances of combined surgery, air or gas is introduced into the vitreous cavity for application of dyes or to flatten the retina. The CTR can maintain zonule-capsular complex integrity, so as to prevent air from entering the anterior chamber, which can cause severe disturbances for intraoperative visualization during posterior segment surgery. We report the use of CTRs in 2 patients who underwent combined phacoemulsification and pars plana vitrectomy with or without gas tamponade.

Case reports

Case 1

A 67-year-old woman with proliferative diabetic retinopathy presented with a history of blurred vision for 2 years. She had previously undergone panretinal photocoagulation in both eyes. Her best-corrected visual acuity (BCVA) in the right and left eyes was 20/40 and 20/30, respectively. Slit-lamp examination demonstrated bilateral immature cataracts and dilated fundal examination revealed laser marks with a grade I epiretinal membrane (ERM) in the right eye and a grade 0 ERM in the left eye. Over the next 18 months,

there was progression of the right ERM from grade I to grade II, with no apparent deterioration in BCVA. Optical coherence tomography was followed by an increase in right central macular thickness to 427 μm , with loss of the foveal depression due to the ERM.

In view of the patient's worsening metamorphopsia, combined phacoemulsification with pars plana vitrectomy and membrane peeling was performed. Endocapsular phacoemulsification was performed via a scleral tunnel at 12 o'clock, after continuous curvilinear capsulorhexis and hydrodissection. At the end of the phacoemulsification, zonular dehiscence was noted extending from the 3 to 8 o'clock position (**Figure 1**). A polymethylmethacrylate (PMMA) CTR (Type 13/11; Ophtec BV, The Netherlands) was therefore inserted to stabilize the capsular bag before irrigation and aspiration. No loss of vitreous was evident and the surgeon proceeded to perform a 3-port pars plana vitrectomy. After vitrectomy, one-stage partial fluid / air exchange at (30 mm Hg pressure) was performed for ERM staining. On introduction of air, however, several air bubbles escaped into the anterior chamber. This was dealt with by gentle massage over the globe to reposition the CTR and expel the air from the anterior chamber. Trypan blue was applied for 1 minute to stain the ERM and the vitreous cavity was refilled with balanced salt solution. Good staining of the ERM was achieved and peeling was performed using an intraocular forceps. After complete removal of the ERM, a single-piece acrylic foldable intraocular lens (IOL) [SA60AT; Alcon, Fort Worth, Texas, USA] was implanted into the capsular bag. The IOL was well-centered and stable at the end of surgery (**Figure 2**), and remained stable postoperatively. Her BCVA in the right eye at the 1-month follow-up was 20/50.

Case 2

A 31-year-old man presented with decreased visual acuity in the right eye 1 day after injury with an elastic cord. Visual acuity in the right eye amounted to light perception, and slit-lamp biomicroscopy revealed a 3-mm hyphema in the anterior chamber with normal intraocular pressure. The crystalline lens was subluxed superonasally with phacodonesis and 120 degrees of zonular dehiscence extending from the 6 to 10 o'clock position. No angle recession was found on gonioscopy. There was vitreous herniation through the zonular defect into the anterior chamber. Dilated fundal examination showed minimal vitreous hemorrhage with a traumatic macular hole of 500 μm in diameter. The patient was initially managed with topical steroids and anti-glaucomatous agents, and the hyphema gradually resolved after 2 weeks. The option of early surgery for the traumatic macular hole was discussed with the patient. He, however, preferred conservative treatment, since spontaneous closure of the traumatic macular hole was a possibility.

Six months after injury, in the right eye his BCVA was 20/300. The traumatic macular hole remained open and there was progressive cataract formation in the subluxed

lens. Phacoemulsification with CTR and IOL implantation combined with pars plana vitrectomy and gas tamponade were performed. After continuous curvilinear capsulorhexis, thorough hydrodissection and hydrodelineation of the lens were undertaken. A PMMA CTR (Type 13/11; Ophtec BV, The Netherlands) was inserted into the capsular bag which resulted in improved lens centration and stability. Endocapsular phacoemulsification was then carried out. Thereafter, standard 3-port pars plana vitrectomy was performed with induction of the posterior vitreous detachment and removal of the posterior hyaloids. This was followed by internal limiting membrane peeling after indocyanine green staining. A 3-piece foldable acrylic IOL (MA60BM; Alcon, Fort Worth, Texas, USA) was implanted into the capsular bag. Fluid / air exchange was performed and 12% perfluoropropane (C_3F_8) gas was injected. There was no IOL tilting or escape of gas into the anterior chamber during and after the surgery.

Postoperatively, the patient was asked to maintain a prone posture for 2 weeks. The gas bubble absorbed completely

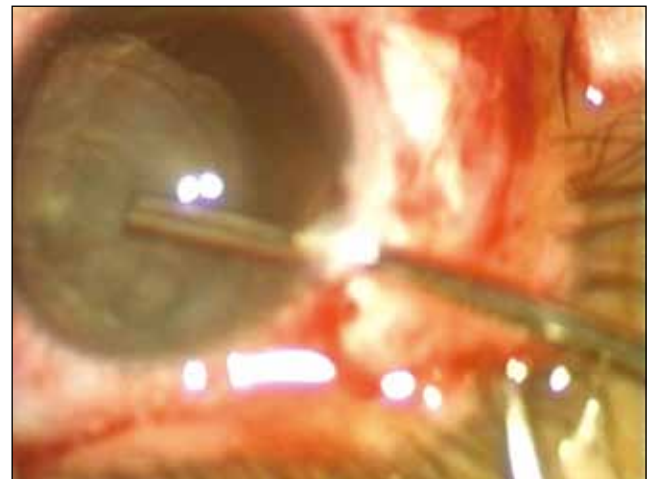


Figure 1. Intraoperative photo showing zonular dehiscence from 3 to 8 o'clock after completion of phacoemulsification.

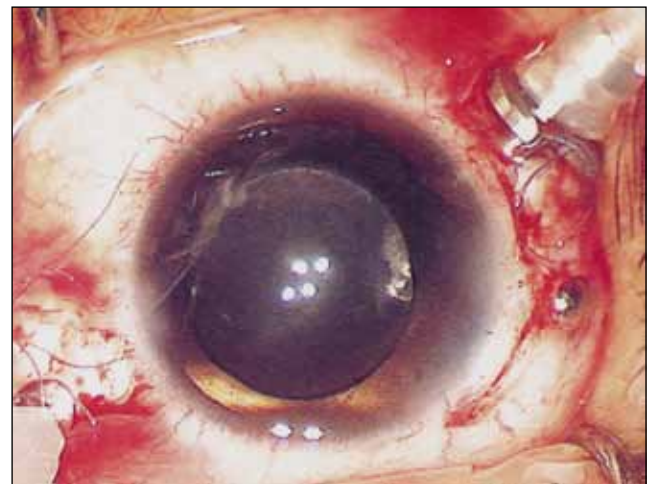


Figure 2. Intraoperative photo at the conclusion of the combined surgery showing well-centered intraocular lens with capsular tension ring in situ.

after 2 months and the IOL within the capsular bag was stable. However, his BCVA remained at 20/300 due to failure of the macular hole to close. Reoperation for the persistent macular hole was suggested, but the patient refused. Nine months after the surgery, there was mild posterior capsular opacification and an Nd:YAG capsulotomy was performed without any complications. Two years after the surgery, his BCVA remained 20/300. There was mild superonasal decentration of the IOL and the macular hole remained open.

Discussion

Common causes of zonular dehiscence and weakness include blunt or surgical trauma, mature cataract, pathological myopia, pseudoexfoliation syndrome and Marfan's syndrome. Common surgical approaches for the management of severe lens subluxation include intracapsular cataract extraction (ICCE) or lensectomy combined with transscleral fixation of rigid PMMA IOL.¹⁰⁻¹² The disadvantage of these techniques is that they require a large incision for lens extraction or implantation of a rigid PMMA IOL. Insertion of a CTR prior to phacoemulsification of the subluxated lens with a zonular defect can redistribute the manipulating forces during cataract removal evenly over the entire zonular complex. It can also prevent further zonular dehiscence and lens dislocation during surgery.^{5,9}

In some forms of lens subluxation (like trauma or pathological myopia), there may also be posterior segment pathologies such as traumatic macular hole or retinal detachment. These may require combined lens and vitreoretinal surgery. In which case, the surgical approach includes pars plana lensectomy and vitrectomy with suture fixation of the IOL.¹³ This procedure is not without

risk as complications (IOL tilting and peripheral anterior synechia formation secondary to the gas tamponade) have been reported.¹³ However, in cases in which the extent of zonular dehiscence is limited, phacoemulsification with CTR insertion followed by pars plana vitrectomy and gas tamponade may provide an alternative surgical option. This approach has the advantage of preserving the zonular and capsular complex for endocapsular phacoemulsification and implantation of the IOL within the capsular bag.

In both of our cases, CTR was inserted to facilitate safe completion of phacoemulsification and implantation of the foldable IOL in the capsular bag. CTR also strengthened the zonular and capsular complex for intravitreal gas tamponade during and after surgery. In the first patient, small gas bubbles escaped through the zonular defect and gentle massage of the CTR facilitated repositioning of the CTR and to expel the air from the anterior chamber. This simple massage maneuver over the CTR might have helped redistribute the prevailing forces so that it became more difficult for air or gas to escape from the vitreous cavity. This allowed good centration of the IOL postoperatively, despite the intraoperative escape of air to the anterior chamber. In the second patient, the support provided by the CTR was excellent since there was no IOL tilting nor escape of gas into the anterior chamber (intraoperatively and postoperatively). Our cases illustrate that combined phacoemulsification with CTR insertion followed by pars plana vitrectomy with or without gas tamponade is a feasible surgical option for managing patients with limited zonular dehiscence who require combined cataract and vitreoretinal surgery. The advantage of this approach in eyes with more extensive zonular dehiscence or dehiscence in the superior quadrants requires further evaluation.

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